RESIDENTIAL STRUCTURE AND INTRA-URBAN MIGRATION

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of
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by

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Dissertations are required to embody the original work of a scholar on a particular subject matter. The present study fulfils this requirement. There are, however, many persons who have contributed in diverse ways to the final production - and deserve recognition.

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PWN

ABSTRACT

At least three major outcomes of the intra-urban migration process can be identified and modelled. These include the decision to move or stay, the nature of housing chosen by mover households, and locational choice. Empirical models are formulated and tested using data from a household mobility survey undertaken in Christchurch in 1974.

Particular emphasis is given to formulating structural models of locational choice, guided by the following general premises:

1. that relocation is undertaken within and is constrained by the existing urban structure, and

2. locational choice behaviour is regarded as the outcome of the interaction of two basic factors: the behavioural propensities of individuals (e.g. preferences) and the constraints (both area and household level) confronting those individuals.

Discriminant models of the type:

$$L = f\ (P, C)$$

are generated in which measures of household preferences (P) and constraints (C) combine to allocate mover households among locations (L) within the city. The suggestion is that urban spatial structure and the behaviour of individuals and households within that structure be considered together, and that models of locational choice should be based on behaviour - structure linkages.

Locations are classified via a principal components-hierarchical grouping analysis route, using an array of population and housing variables, In addition to the identification of variables necessary for an explanation and prediction of household locational choice, important features of the modelling exercise include:

1. an examination of the influence of vacancy structure and pattern on model performance

2. an assessment of the influence of area homogeneity on the explanatory and predictive power of a location allocation model,

3. an investigation of the role of an area's location within the city system in locational choice modelling, and

4. model validation.

CHAPTER ONE

INTRODUCTION

Research into intra-urban migration undertaken over the past decade or so can be readily assigned to one of two classes: ecological analysis or survey research. Examples of the former approach, where an ecological analysis of the correlates of residential mobility is an explicit objective, are relatively few in number (Moore, 1966a, 1966b, 1971; Brown and Longbrake, 1970; Meyer, 1971). More numerous are the factor ecological studies whose main purpose is the identification of an urban area's residential structure together with those spatial patterns associated with the resulting set of structural dimensions (see Berry, 1971 and Rees, 1970, 1972, for a review). Within this research context, intra-urban migration is normally advanced as one of the principal mechanisms involved in the differentiation of residential areas (Timms, 1971).

Survey studies which focus on the residential mobility of individuals or households as opposed to aggregate or area mobility characteristics have been appearing at an increasing rate since the early 1920s. In reviewing work published up until the mid 1960s, Simmons (1968) provides an explanatory sketch of research findings related to the characteristics of movers, mobility determinants, and factors influencing residential locational choice. However, it was Brown and Moore (1970) and to a lesser extent Sabagh, Van Arsdol and Butler (1969), Kaiser and Weiss (1969) and Butler et. al. (1969) who developed a detailed conceptual model of the residential choice process upon which much subsequent research has been based.

However conceptually satisfying a linked model of the residential relocation process may be, the problems of attempting to integrate a multi-stage and multivariate process into a single functioning model with adequate explanatory and predictive capacity suggests that a more realistic approach may be one which focuses on a number of models which deal with important aspects of the residential mobility process. Such a step would achieve two objectives. Firstly it would remove problems associated with the sequencing of events within the relocation process. As Lee (1975) has recently indicated, it is possible that in many cases the migration desitnation is chosen before a decision to move is made at all:

> *... some destinations lie within long-established aspiration zones to which migration is delayed until changed circumstances alter the place utility of the present location so markedly that the threshold of the migration decision is crossed.*

Secondly, it should encourage the establishment of statistical models capable of predicting certain outcomes at particular stages of the relocation process. Formulation of statistical models is desirable in that they require the operationalisation of concepts central to the activity or behaviour under study, and they permit an empirical assessment of the utility of particular factors to an overall explanation and prediction of the behaviour in question.

At least three major outcomes of the residential mobility process can be identified and modelled. These include the decision to move or stay, the nature of housing chosen by mover households, and thirdly, locational choice.

1) Residential Mobility Models

Moore's (1969b) critique of the restricted nature of previous intra-urban migration studies can be seen as the beginning of a new approach which recognises that the determinants of residential mobility can only be properly identified by contrasting the household profiles of both movers and non-movers[1]. Similar arguments have been advanced more recently by Morrison (1973) who also encourages a shift in emphasis from the dichotomous mover-stayer framework to one in which individuals or households are arrayed along a continuum that ranges from 'easily movable' to 'virtually immobile'. The problem with the binary mover-stayer model (see Goodman, 1961) has been that it exaggerates the similarity within the mover and stayer groups. In a two-phase mobility survey, such as that undertaken in the present study, it is possible to isolate the following household types for a given time period:

Phase I: Household Mobility Plans	Phase II: Household Mobility Behaviour	Type of Household (A Posteriori Designation)
Planned stayers	Stayed	Expected stayers
Planned stayers	Moved	Unexpected movers
Planned movers	Stayed	Unexpected stayers
Planned movers	Moved	Expected movers

The task then becomes one of determining those factors responsible for the type of group separation specified. A review of recent research findings suggests several possible underlying factors: residential dissatisfaction (Butler et. al, 1964, 1969; Chapin and Logan, 1969; Speare, 1974); residential stress (Wolpert, 1966; Brown and Moore, 1970; Clark and Cadwallader, 1973); contextual position (Oyen, 1969); and household and residence characteristics (Speare, 1970; Butler and Kaiser, 1971; Pickvance, 1973; Mohan, 1975). An assessment of the relative importance of the abovementioned factors in an examination of mover and stayer group differences can be achieved through discriminant analysis (Casetti, 1964; Tatsuoka, 1970). A discriminant model will not only establish whether a number of discrete groups (such as the four mover-stayer groups previously outlined) differ significantly from one another, but will also indicate those variables which best serve to differentiate the various groupings.

2) Residence Choice Models

The second major group of models concerns the aspatial outcome of household mobility behaviour. The outcome of a residence-shift can be characterised in many ways: in terms of tenure, dwelling type, dwelling size, number of bedrooms, size of building lot, cost of the entire property, etc. Such outcomes are clearly aspatial as there is no locational identification necessarily associated with any of the dwelling-related variables.

The statistical model normally used to facilitate explanation and prediction of the demand for housing is multiple regression analysis, where the dependent variable generally relates to some overall representation of the value or cost of housing selected by the mover households (see Silver, 1970). More recently, Apps (1974) has presented a series of disaggregated models which attempt to account for household demand for various housing services, the hypothesis being that differences in level of demand can be accounted for by household income, social status, household size and stage in the family cycle. Initial results have been disappointing.

An alternative approach to the study of residential choice is currently under investigation by Kaiser and his associates (Kaiser et. al., 1971). Focusing specifically on the tenure and dwelling type outcome, path analysis is being employed to establish causal connections between a set of household related variables (namely age, family cycle position, race and income) and particular move outcomes. Yet another approach can be found in a study by Perilla (1972) who used linear discriminant analysis to probe differences in preferences for dwelling and neighbourhood attributes among groups of households differentiated with respect to occupation type. Multiple discriminant analysis was also employed by Doling (1973) when modelling the tenure choice of households in Derby.

3) Locational Choice Models

In many respects the variety of hypotheses and findings which characterise residential mobility study at the present time[2] suggest the potential for numerous models of locational choice. That a situation of indeterminacy continues to exist in this area of research is due in part to the apparent hesitancy in setting up and testing models of locational choice - models which are of sufficient generality to permit replication in environments other than those in which they were formulated.

To date, the studies of Adams (1969), Whitelaw and Robinson (1972), Whitelaw and Gregson (1972), Brown and Holmes (1971), Clark (1970, 1971, 1972), Poulsen (1972), Donaldson (1973) and Donaldson and Johnston (1973) have been unable to demonstrate a consistent relationship between the distance and direction which households move within cities when changing residence and certain characteristics of these mover households (for example income, age, etc.). This is due in no small part to the influence exerted on the movement parameters of distance and direction by the particular configuration of differentiated residential areas within a city. In many respects the distance and direction that households move in relocation are spatial artifacts of the behaviour of households within the constraints of a particular urban area's residential structure.

Given the difficulties associated with geometric models of intra-urban migration, and the gross nature of any locational outcomes predicted by such models (typically to entire 'sectors' or 'corridors' within the city; see Poulsen, 1974 for example), an alternative framework for models of locational choice is clearly required.

The premise underlying the locational choice models formulated and tested in the present thesis is that the existing residential structure of an urban area not only acts to condition residential mobility behaviour (see Oyen, 1969; Horton and Reynolds, 1971; Clark, 1972), but also plays a major role in determining the final spatial outcome of an intra-urban move. The suggestion is that urban spatial structure (as determined from factor ecological analyses and their extensions) and the behaviour of individuals and households within that structure should be considered together, and that models of locational choice be based on behaviour-structure linkages. The advantages to be gained in terms of model building and the development of a broader based theory from an integration of individual and aggregate analyses have been recognised in a number of social science disciplines (Scheuch, 1969; Linz, 1969; Back, 1973), but only recently within geography (Kosinsky and Webb, 1975).

The Formulation of a Statistical Model of Locational Choice

Berry and Rees (1969; see also Rees, 1970) provide the basis for an integrated model of residential location by specifying how the principal findings from factor ecological analyses can be linked with individual household data. Their model-framework is based on the assumption (see Berry, 1971) that a city's residential structure can be described by two major dimensions, socio-economic status and stage in the life cycle. These two dimensions define, at the sub-area or census district level, what Rees terms community space - although additional dimensions relating to housing, minority groups and workplaces may be seen as necessary additions for a more complete definition of a city's community structure[3]. These various types of communities can be readily assigned to locations in the city's physical space.

The two dimensions of socio-economic status and stage in the life cycle may also be used to locate an individual or a household, according to their economic and family characteristics, in social space. The model-argument for residence choice then proposes that the household matches its position in social space with that of a dwelling located in an analogous position in housing space[4]. According to Rees, the locational requirements of a mover household are met from a range of possible communities within the same community space type[5]. One of the objectives of the present study therefore, is to empirically test the proposition that the type of community or area type in which a household chooses to locate is related to its socio-economic position, its stage in the life cycle, and the type and quality of housing that the household requires and can afford.

It could be argued, however, that locational choice models based on population and/or housing typologies are essentially aspatial. Their spatial basis would only be implicit, the argument being that since the data relates to areal units, the spatial component is already built in; the objective of the models is then to establish the extent to which 'certain types of households choose, or are forced to live in certain types of area'.

To stop at this stage in our residential modelling would discount the role of location in household relocation behaviour. The nature of urban areas, where different land uses (and residential areas) are spatially separated, suggests that access may be an important constraint on residential choice. A locational constraint can be built into locational choice models via the entry of a contiguity constraint in areal classification. An intra-urban move can then be characterised according to its regional/locational, as well as its area-type outcome. This difference can be illustrated with reference to Figure 1.1. Assume, for the purpose of argument, that the move Ø-λ is to region II. If allocation of this household had been among area types, then the potential destination area would have included all sub-areas of type A classification (i.e. regions I and II belong to the same area type). Notwithstanding the fact that there should be a greater number of sub-urban regions than area-types (thereby increasing the potential for misallocating mover households), it is anticipated that if location within the city proves to be an important factor in household relocation behaviour, then model performance should improve when allocation is undertaken to sub-urban regions as opposed to area-types.

The decision to establish models based on what is usually considered to be the objective structure of a city relates to the particular phase of the residential mobility process under examination: that is, the final selection of a dwelling and location. It is proposed that immediately prior to the final locational choice being made, a household's need for objective information about dwelling, neighbourhood and locational attributes is maximal. Under this assumption we can proceed to argue that:

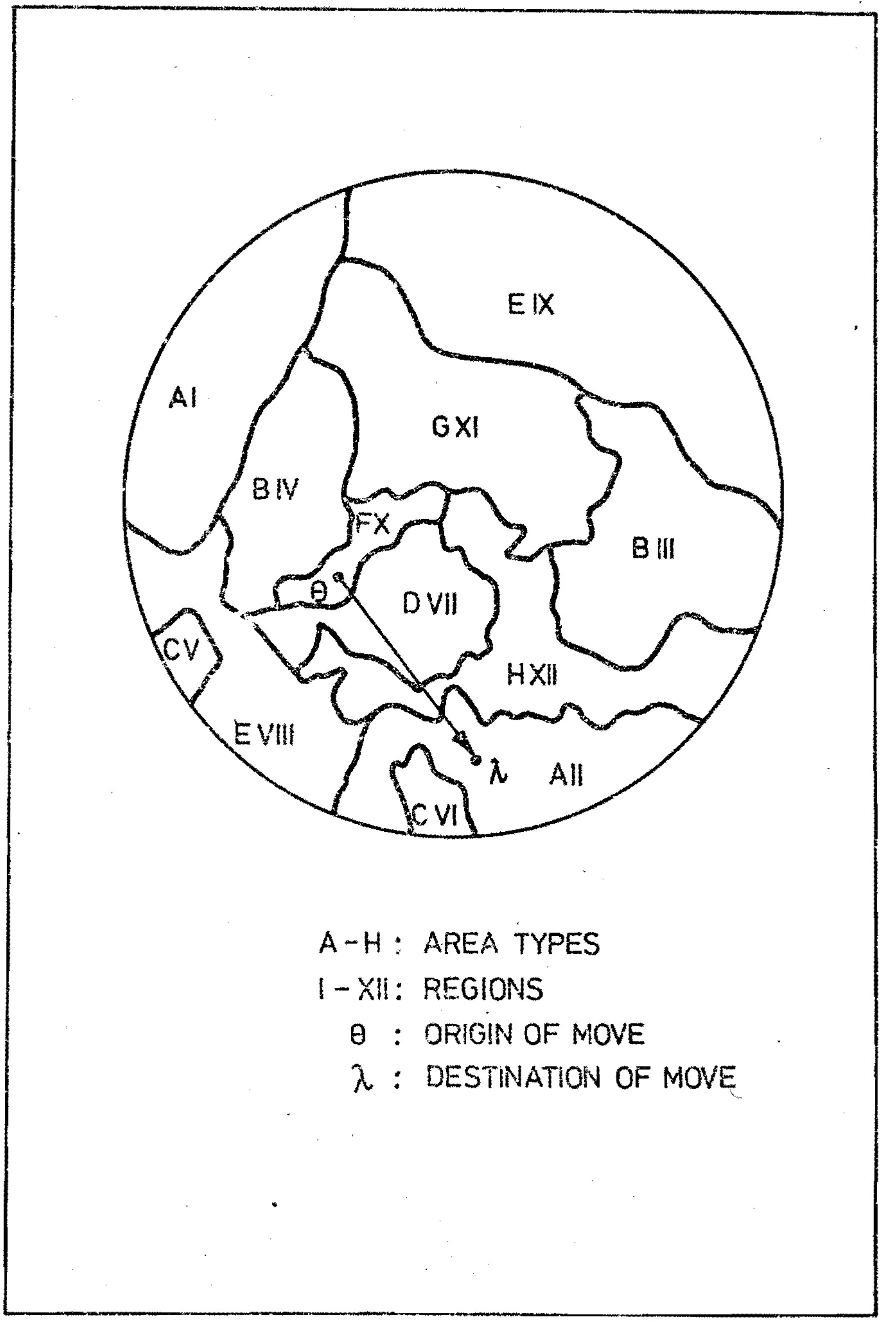


FIGURE 1.1 : BASIS FOR A STRUCTURAL MODEL OF LOCATIONAL CHOICE

1) locational choice behaviour occurs within and is constrained by, the existing urban structure,
2) this structure can be identified and found to comprise several dimensions,
3) residential areas can be classified or regionalised with respect to each or all of these dimensions,
4) these distinctive groups of residential areas constitute sets of potential destination areas for mover households, who likewise can be defined in terms of the attributes they possess, their housing needs and so on.

In modelling this structure-behaviour linkage, the type of area (community type or region) chosen by a mover household becomes the dependent variable in an equation of the form:

$$L = f\ (S_i) \quad \ldots\ [1]$$

where L is a scalar representing the attributes of the location selected by the mover household; and

X_i is a set of household characteristics and household residential needs and preferences.

If we knew all the variables that are involved in locational choice (the X_i), and could measure all of them, it would be possible to predict an exact value of L for given values of the X_i, provided also that the function (f) were known. However, all the variables in the locational choice process have not been identified, and some of those which have either cannot be measured or are imperfectly measured and as a consequence the nature of the functions is not known.

This situation necessitates the selection of an empirical statistical model that can be evaluated from observational data. One possibility is the linear model, which has been found to give a good approximation to many outcomes which involve the interaction of a number of variables. The general locational choice model to be developed utilises multiple regression and multiple discriminant analysis to make descriptive statements about the relocation behaviour of mover households. The standard form of the linear models is:

$$L = a_1 X_1 + a_2 X_2 + \ldots + a_n X_n \quad \ldots [2]$$

where the several coefficients (a) represent the contribution of the corresponding household characteristics (X) to an explanation of locational choice behaviour.

In the present study, predictive and explanatory models for the three mobility outcomes (residential mobility, residence choice and locational choice) are established for a sample of households resident in Christchurch in 1974 (for a brief introduction to the general geography of Christchurch, see Appendix I).

Outline of Thesis

The preceding section has broadly canvassed the content area for the present study and has indicated where particular emphasis is to be centred[6]. This preamble is now developed with explicit reference to the various segments in the study.

The research is directed towards an explanation and prediction of intra-urban residential mobility. This is not to suggest that our knowledge of residential mobility determinants is at a low level. On the contrary, there are numerous concepts and empirical generalisations which have been advanced to explain aspects of residential mobility activity. Most, however, would qualify as explanatory sketches.

Around the time at which the present project was initiated (February, 1973) it seemed appropriate to assess the utility of existing frameworks or schemas in the study of intra-urban migration. It was also apparent that one of the legacies of many mobility studies undertaken over the past ten to fifteen years included a large array of variables found to have some relationship with mobility behaviour. Clearly, some form of synthesis was required.

A mobility schema which permits an assessment of the contribution of several variables to an explanation of some criterion variable, and at the same time facilitates replication, is one which recognises the existence of major outcomes within the residential relocation process - outcomes which have significance in their own right and, for the most part, demand separate study. The nature of the three principal outcomes outlined earlier are such that all may be successfully represented by a form of linear model (e.g. regression or discriminant analysis). This represents an important component of the study.

Major emphasis is being placed on modelling locational choice - the move outcome which can be seen to exert the greatest influence on an urban area's residential structure and pattern. The resultant models are termed structural models, to signify their independence from the more widely known geometric models of locational choice and to denote their conceptual attachment to the premise that household locational choice behaviour occurs within, and is constrained by, the existing urban structure. In order to operationalise a structural model of locational choice, a first requirement is the isolation of dependent variables for inclusion in the model equations (ref: Equations [1] and [2]). Involved here is a determination of the principal dimensions of an urban area's residential structure in terms of:

1) The social and demographic characteristics of the population,
2) the number and variety of housing submarkets,
3) the number and variety of vacancy submarkets for different time periods, and
4) the accessibility surface of the urban area.

In deciding upon the nature of the models to be developed within the present thesis, consideration was also given to several generalisations which have emerged from the literature on residential location. Four are taken as initial guiding premises for generating a model (or models) of locational choice. The generalisations indicate that when changing residence within a city a mover household will (or may):

1) choose or be forced to live among households with similar social and demographic characteristics to its own,
2) select areas which contain housing and amenities with the necessary attributes to satisfy its residential needs,
3) locate in that part of the city which meets its accessibility requirements to those nodes with which there is frequent, routinised contact, and
4) be constrained in its residential choice by
    (a) the availability and/or
    (b) the cost,

    of various housing (or land) bundles located at different points within the city.

That these four generalisations relate to the major components of urban residential structure reflects the major research objective of the study: examining the tenability of structure - behaviour models of locational choice. It has also suggested a major division for the thesis.

Following the introductory chapter, the first part of the study (Part A, Chapters 2 to 5) is concerned with an identification of the major dimensions of urban structure which characterise the residential areas of Christchurch, New Zealand. Part B includes those chapters concerned with modelling the three outcomes of the residential movement process: the decision to move or stay, the choice of residence and the choice of location (Chapters 6 and 7), together with a conclusion (Chapter 8).

The focus for Chapter 2 is the social and demographic structure of Christchurch's residential areas. Census data relating to population characteristics comprise the input for several factor ecological analyses. In addition to determining the principal dimensions of social and demographic structure, and classifying residential sub-areas along these dimensions, a further section of Chapter 2 is concerned with establishing the extent to which the component structure and pattern is invariant under different methods and scales of analysis. The result has important implications in so far as the reliability and validity of the locational choice models are concerned, since the dependent variable for such models is based on the major dimensions of urban residential structure derived via factor analysis.

As in Chapter 2, the basic methodology for Chapter 3 (and Chapter 4) is that of factorial ecology. In terms of content, however, the third chapter is concerned with analysing the housing structure of the urban area using data drawn from the Government Valuation Department. The results of the housing submarket analyses will be employed, in a similar manner to those in the previous chapter, in an explanatory model concerned with allocating mover households among residential sub-areas within Christchurch. In addition, tests are made to determine the homogeneity of all residential sub-areas in terms of several housing (and population) variables. The heterogeneity of the residential sub-areas of the city is likely to exert a major influence on the predictive efficiency of the structure-behaviour models of locational choice. The form of the models to be developed depend, for a high degree of explanation and prediction, on the degree of mix among population and housing characteristics in the potential destination areas. As such, the greater the heterogeneity of an area, the greater is the potential for households with quite different residential needs to relocate within the same residential unit. In other words, the greater the heterogeneity of residential sub-areas, the greater is the likelihood of misallocating mover households when a structural model is used as a basis for location allocation. This problem can be overcome by 'building-in' a correction for heterogeneity within the model.

The existing residential structure of an urban area is not the sole factor which constrains or directs residential movement within the city. Mover households are further constrained by the availability and cost of housing located at various positions within the city. Using data from multiple listing cards and newspaper advertisements, the spatial and temporal variations in Christchurch's vacant housing market are examined (Chapter 4) for a period which parallels the household mobility survey. This provides an opportunity for assessing the contribution of a vacancy constraint in an explanation of a household's locational choice.

By the end of Chapter 4, the set of structural dimensions which is to form the basis of the locational choice models established and tested in Part B has been determined. It provides for the formulation of several unidimensional models in which mover households are allocated to areas differentiated by a single component of urban residential structure (e.g. housing quality; resident socio-economic status, etc.). Such models would provide, at best, only partial representations of locational choice behaviour. A multidimensional typology of Christchurch's residential areas, employing the principal population and housing dimensions identified in the earlier chapters, is undertaken in Chapter 5. This permits the formulation (in Chapter 7) of a locational choice model capable of allocating mover households among area types. Location allocation, the final phase of modelling, is afforded by a multidimensional regionalisation (undertaken in Chapter 5) of Christchurch's residential sub-areas.

Part B is wholly concerned with modelling move outcomes. The nature of the Christchurch mobility survey (January-October, 1974), which provides the necessary data for setting up and testing empirical models, is discussed in Chapter 6. Residential mobility and residence choice models are also formulated within this chapter.

In Chapter 7, an attempt is made to predict the locational choice of a sample of households who undertook a residence - shift within Christchurch during 1974. As well as isolating those variables which contribute most to an explanation of household mobility behaviour, interest also centres on the role of the vacancy pattern in directing residential movement, and the influence that area homogeneity has on the predictive efficiency of the allocation model. By contrasting the performance of the locational choice model when allocating mover households to area types as opposed to sub-urban regions, it is possible to gauge the extent to which location, in addition to area characteristics, is an important variable in household locational choice behaviour.

NOTES

1 A number of examples of studies which surveyed only mover households can be found. These include: Munson, 1956; Whitney and Grigg, 1958; Leslie and Richardson, 1961; Ross, 1962; And Kalbach, Myers and Walker, 1964.

2 Examples of studies which have focused on particular aspects of household residential mobility behaviour

include: Horton and Reynolds (1969) action and activity space; Brown, Horton and Wittick (1970), Meyer (1970) place utility; Herbert (1973), Rossi (1955) information sources; Bell (1956), Michelson (1970) life styles; Daly (1968) accessibility; Pryor (1969) residential satisfaction.

3 It should be noted, however, the aggregate-level studies by Parkes (1972) in Newcastle, N.S.W. and Hartshorne (1971) in Cedar Rapids both report a high level of agreement between an area's position in social space and its position in housing space.

4 Preliminary confirmation of this link has been recently provided by Yeates (1972b).

5 The terms 'community space type' and 'area type' are used interchangeably in the present study.

6 Discussion, and where applicable, critique, of literature relating to urban residential structure, intra-urban migration and multivariate modelling techniques, is undertaken within the relevant chapters.

PART A

ELEMENTS OF CHRISTCHURCH'S URBAN RESIDENTIAL STRUCTURE

CHAPTER TWO

SOCIAL AND DEMOGRAPHIC DIMENSIONS OF CHRISTCHURCH; SOME TESTS OF THE INVARIANCE OF STRUCTURE AND PATTERN

Much of the stimulus for the analysis of urban structure has come from the Shevky-Bell formulation of social area analysis (Shevky and Bell, 1955). Although their attempt at a theoretical connection between dimensions of residential differentiation and the changing scale of society has been severely challenged, (Hawley and Duncan, 1957; Van Arsdol et. al., 1961) modified (McElrath, 1965, 1968) and finally seen as reflecting both the process of modernization and the location behaviour of individual households (Udry, 1964; Timms, 1971), empirical evidence from replication studies have confirmed the three dimensional model of urban social structure (see Parkes, 1971 for a review of these studies). The three dimensions of the Shevky-Bell typology to which we refer, namely social rank (socio-economic status), urbanization (family status, stage in the life cycle) and segregation have also continued to emerge from the more inductive factorial ecology, which now represents the accepted methodology for identifying dimensions of urban structure.

The expanded variable set which characterise most factorial ecologies has tended to partially confuse the basic three dimensional pattern. Johnston (1974a) has argued, however, that an increased variable set does not deny the Shevky-Bell constructs, but instead adds to them, revealing aspects of urban structure which were either overlooked by the social area analysts in their search for high-level generalisations, or were not relevant to their data sets and study areas. Many studies which post-date the Shevky-Williams-Bell analyses have either added to the initial triad, or have drawn attention to the existence of clusters of dimensions rather than single dimensions as postulated by Shevky and Bell[1].

In recent years a number of criticisms have emerged which express some concern about the nature of the data used in factorial ecologies and involve a questioning of certain aspects of the methodology itself. As far as the first point is concerned, Palm and Carnso (1972) have argued for an input of variables more closely allied to decision-making and spatial behaviour in addition to the usual set of structural variables. This calls for data collection along sample survey lines, an approach which would appear feasible only for small centres (Forrest, 1973) or for a small sample of residents from the larger urban areas (Artz et. al., 1971). Most workers would, no doubt, appreciate the advantages to be gained from working with such a data set. However, the economics of research dictate that, at least for the present, the necessary alternative remains the Census and its acknowledged limitations (Johnston, 1974a).

On the second point, methodological criticism of factorial ecology ranges from the nature of the data input to the computation and mapping of factor scores[2]. In examining the social and demographic structure of Christchurch, attention will focus in turn upon:

1) a review and critique of previous studies of residential differentiation in Christchurch,

2) an analysis of the structure and patterns of residential differentiation in Christchurch in 1971, and
3) an examination of the extent to which the residential structure and pattern is invariant under different methods and scales of analysis. Irrespective of whether within-city classification is undertaken as an end in itself, or a precursor to further analyses (for example: comparative factorial ecology, contextual position, locational choice modelling, etc.) it is important to demonstrate the stability or otherwise of the resultant spatial structure and pattern. A failure to do this renders subsequent practical or theoretical applications potentially invalid.

THE SOCIAL AND DEMOGRAPHIC STRUCTURE OF CHRISTCHURCH: PREVIOUS STUDIES

A number of factor ecological studies have been undertaken on Christchurch's residential population. The comparative factorial ecologies[3] of Timms (1970a) and Johnston (1973a), while analysing data for the same base period, 1966, are quite different in approach. Timms' study is concerned both with testing hypotheses related to the Shevky-Bell triad of urban structural factors, and exploring the dimensionality of a set of social area variables. His choice of factor models reflect the two objectives: multiple group factor analysis for the former and principal components analysis the latter. The results of both analyses are presented in Table 2.1. From an inspection of the multiple group factor loadings and correlations between the factors he was able to conclude that,

TABLE 2.1

URBAN SOCIAL STRUCTURE
CHRISTCHURCH 1966 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% FEM NEV. MARR'D	-93(95)			94
% FEMALES WORKING	-95(91)			93
% ONE FAMILY HHOLDS	96(-94)			95
% SEP,DIVORCED FEM	-95(88)		(42)	94
% WIDOWED FEMALES	-78(91)		-55	91
% RENTED DWELLINGS	-95(89)			91
% 0-5 YEARS	61(-80)	(-32)	70(37)	90
% OVER 65 YEARS	-60(77)		-66	80
% NON-MANUAL WORKERS		91(95)	(-57)	93
% MALES EARNING $3000+		97(95)	(-42)	96
% MALE PROFESSIONAL	-32(40)	87(91)	(-48)	92
% SELF EMPLOYED MALES		94(94)	(-45)	89
% MAORI	-41	-55(-58)	56(91)	79
% OTHER POLYNESIAN		(-35)	84(91)	77
CUMULATIVE % VARIANCE	48	72	90	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS(MULTIPLE GROUP FACTOR ANALYSIS)
VARIABLES UNTRANSFORMED
LOADINGS OVER 30 INCORPORATED IN TABLE
SOURCE : TIMMS(1970,P.460)

COMPONENT LABEL
1.FAMILISM-URBANISATION (FAMILISM-URBANISATION)
2.SOCIAL RANK (SOCIAL RANK)
3.ETHNICITY-AGE (ETHNICITY-AGE)

> *The results of the multiple group factor analysis are essentially congruent with the hypotheses derived from the social area model. Independent social rank and familism-urbanization factors are apparent in each city, while ethnicity shows a high negative correlation with social rank in all the cities except Dunedin. (Timms, 1970a, p. 460.)*

A principal components analysis (with varimax rotation) revealed a structure similar to that in the multiple-group analysis for the two primary dimensions. The ethnic variables, however, seem to have aligned themselves to a greater extent with the familism-urbanization variable set, producing what Timms calls an ethnicity-age factor:

> *In Christchurch high ethnicity appears to be associated with a young, suburban population. (Timms, 1970a, p. 461.)*

The overall conclusion is that social rank and familism-urbanization are fundamental dimensions of residential differentiation in Christchurch, but there is some ambiguity with regard to ethnicity.

Johnston's attempt to identify the dimensions of residential differentiation for Christchurch involved an examination of partial factorial structures and a total factorial structure. The former approach represents a variation to the usual factorial ecology method, whereby the original variable set (82 variables) was divided into sections comprising a family status, social status, minority status and housing set and then factored (principal components, varimax rotation). The resulting components were examined in their own right as well as becoming input for a final analysis. The partial factorial structures for each major component-type tend not to advance our understanding of the underlying concepts of social status, ethnicity and housing particularly far, however. Nor do they seem to aid in producing a clearer set of 'higher-order' dimensions when subjected to a further principal components analysis. Due partly to this fact, further investigation of Christchurch's social structure was based on analyses of the full 82 variable data matrix. Having undertaken the partial factorial analyses, an opportunity seems to have been lost to use the output to screen out variables whose contribution to an explanation of residential differentiation was minor. This should have been an important consideration due to:

1) Johnston's own acknowledgement (p. 144) that large data matrices often create many problems of interpretation.
2) the fact that in his study there were 82 variables and only 38 observations. A common rule of thumb (Nunnally, 1967; Clark, Hosking and Rankin, 1974) in R-mode analyses is to have at least as many observations as variables.
3) the likelihood of 'building in' relationships by employing an exhaustive set of categories for each variable. The prior predictability of relationships from closed number systems has been noted by Krumbein (1962).

When the full 82 variable data set was analysed, four components were found to summarise the social and demographic structure of Christchurch, namely: <u>non-familism</u>, <u>general socio-economic status</u>, <u>old-young</u> and <u>minorities</u>. Less than 75 percent of the variation among the variables was accounted for.

For a number of reasons then, some of which have already been mentioned, analysis of the social and demographic structure of Christchurch in 1971 seemed necessary. Most studies of social area change (Johnston, 1973b; Hunter, 1971a; Brown and Horton, 1970; Haynes, 1971; Timms, 1970b; Greer-Wootten, 1968), while establishing the similarity of major urban structural dimensions between intercensal periods, indicate that over the same period certain areas undergo change on one or more dimensions of their residential structure. An increase of over 40 percent in the numbers of Maoris living in the Christchurch urban area between 1966 and 1971 suggests that some change could be expected on a minority status dimension, even though their numbers remain relatively small (Table 2.2). In addition, both Timms and Johnston used a set of areal units which was far from ideal, a fact they both recognised. For Christchurch in 1966, a total of 42 census subdivisions constituted the areal framework for ecological analyses, many of the outer subdivisions having a population in excess of 8000. Johnston excluded these from analysis to 'avoid bias', arguing that the residential differentiation patterns 'ought not to be significantly affected by the omission of parts of the city'. Janson's (1968, 1974) studies of Newark suggest otherwise. By including all subdivisions in his study, Timms was using areal units with a high degree of heterogeneity. Consequently, a component score for one of the large subdivisions is unlikely to provide a representative measure of the types of household resident within its boundaries. The 1971 census, on the other hand,

TABLE 2.2

SIZE OF ETHNIC GROUPS RESIDENT IN THE MAJOR
NEW ZEALAND URBAN AREAS , 1971.

BIRTHPLACE	URBAN AREA AUCKLAND *	 **	 WELLINGTON		 CHRISTCHURCH		 D UNEDIN	
U.K.	81,493	12.54	21,683	7.05	25,813	9.35	9,009	8.11
AUSTRALIA	14,513	2.23	4,144	1.35	3,958	1.43	1,462	1.32
U.S.A.	1,634	0.25	554	0.18	801	0.29	252	0.23
CANADA	1,858	0.29	310	0.10	413	0.15	128	0.11
NETHERLANDS	4,917	0.76	1,504	0.49	2,967	1.07	988	0.89
POLAND	382	0.06	645	0.21	108	0.04	51	0.05
YUGOSLAVIA	2,206	0.34	260	0.08	122	0.04	19	0.02
GREECE	128	0.02	1,030	0.33	70	0.03	37	0.03
GERMANY	946	0.15	462	0.15	260	0.09	91	0.08
ITALY	345	0.05	342	0.11	82	0.03	47	0.04
INDIA	2,274	0.35	794	0.26	322	0.12	99	0.09
CHINA	1,183	0.18	724	0.23	270	0.10	200	0.18
FIJI	1,004	0.15	188	0.06	75	0.03	39	0.03
POLYNESIA	27,284	4.20	8,329	2.71	1,535	0.56	509	2.18
N.Z.MAORI	45,777	7.04	15,558	5.06	4,440	1.61	924	0.83
TOTAL URBAN AREA POPULATION	649,746		307,629		275,968		111,05 9	

* NUMBER IN ETHNIC GROUP

** PERCENT OF URBAN AREA POPULATION

provides a data set for Christchurch based on 320 census districts (CD's), the potential for within-area homogeneity is, therefore, much higher.

Since the short term predictive locational choice models established in Part B are based in large part upon the existing population and housing characteristics of residential sub-areas, a satisfactory allocation of mover households to residential environments within Christchurch will require an areal classification which employs the smallest possible spatial units and the most recent housing and demographic data.

THE SOCIAL AND DEMOGRAPHIC STRUCTURE OF CHRISTCHURCH, 1971

A recent paper by Johnston (1974a) provides a comprehensive outline of the set of procedures and operations involved in within-city classification (see also Rees, 1972; Davies, 1973). Most of these have been adopted for the present study (see Figure 2.1).

The majority of studies concerned with the classification of residential areas on the basis of attributes of their resident populations choose census data as the primary source of material for analysis. Without access to individual household data, delimitation of residential sub-areas with a high degree of homogeneity on selected variables is difficult. However, so long as the spatial scale at which household data is aggregated is maintained at a reasonably low level (e.g. city blocks) the problem of excessive heterogeneity can be minimised. For the 1971 New Zealand census, the Department of Statistics tabulates data at three scales:

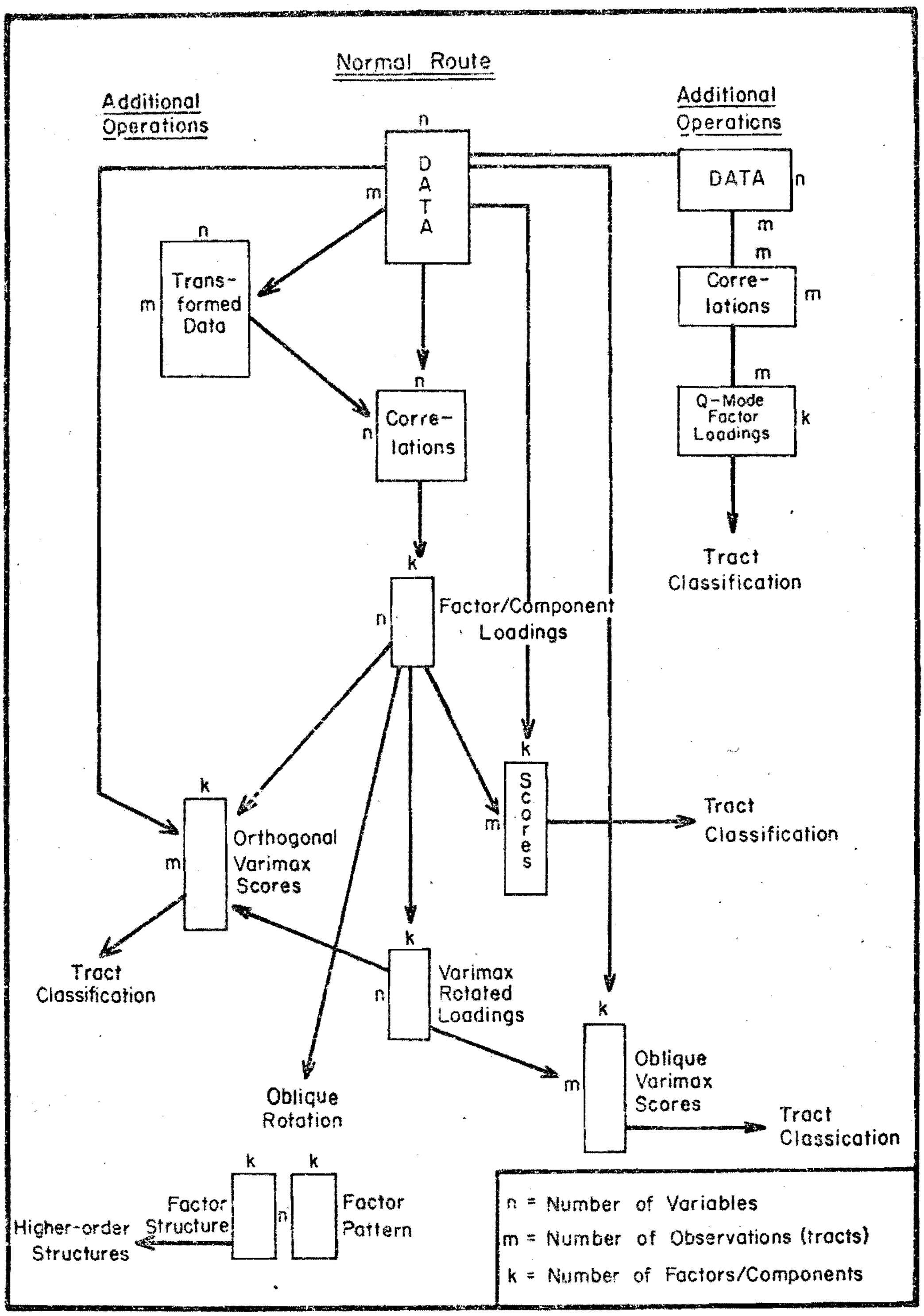


FIGURE 2.1 : SCHEMA FOR MULTIVARIATE CLASSIFICATION (After Johnston, 1974)

1) mesh blocks (2,800 within Christchurch Urban Area)
2) census districts (320 within Christchurch Urban Area; Figure 2.2)
3) subdivisions (86 within Christchurch Urban Area; Figure 2.3).

Confidentiality requirements prevented access to mesh block data, subdivision data being the only information published. Data at census district level was obtained with an aim of determining the influence of scale on the social and demographic structures and patterns of Christchurch's residential areas.

An initial set of 33 'variables'[4] derived from tabulations at census district level were reduced to a final set numbering 14 (refer to the intercorrelation matrix, Table 2.3). Variable-reduction of the type undertaken in the present analyses rarely alters the results of principal component analyses (Jolliffe, 1972). However, it does remove the likelihood of multicollinearity[5].

The principal axes-varimax model was chosen for initial analysis of the social-demographic data matrix for several reasons:

1) its widespread, albeit sometimes uncritical use in geographical analysis. That the technique is common to most studies of residential idfferentiation facilitates the comparison of Christchurch's component structure with those of other cities.
2) its acknowledged utility in identifying basic structures underlying a domain of variables, and the facility it provides for classifying areal units into types with

CHRISTCHURCH URBAN AREA, 1971: CENSUS SUBDIVISIONS

Christchurch City

1. Northcote
2. North Beach
3. Aorangi
4. Papanui
5. Strowan
6. Malvern
7. Mairehau
8. Shirley
9. Burwood
10. Wainoni
11. Rawhiti
12. Aranui
13. New Brighton
14. Bexley
15. Chisnall
16. Avonside
17. Richmond
18. North Richmond
19. Edgeware
20. St. Albans
21. City East
22. City Central
23. City West
24. Merivale
25. Addington
26. Sydenham
27. Waltham
28. Linwood
29. Ensors
30. Woolston North
31. North Linwood
32. East Linwood
33. Bromley
34. South Brighton
35. Woolston South
36. Opawa
37. St. Martins
38. Beckenham
39. Somerfield
40. Spreydon
41. Barrington South
42. Barrington North
43. Hoon Hay South
44. Hoon Hay
45. Hillmorton
46. Mt. Pleasant
47. Clifton
48. Sumner

Riccarton Borough

49. Riccarton
50. Riccarton West
51. Riccarton South
52. Hornby North
53. Hornby South

54. Halswell C.T.

55. Sockburn C.T.

56. Lyttelton Borough

Waimairi County

58. Sawyers Arms
59. Belfast
60. Styx
61. Styx Mill
62. Redwood
63. Casebrook
64. Marshland
65. Kaimahi
66. Harewood
67. Russley
68. Burnside
69. Bishopdale
70. Wharenui
71. Upper Riccarton
72. Fendalton
73. Jellie Park
74. Wairarapa
75. Westburn
76. Ilan
77. Avonhead
78. Masham
79. Merrin
80. Middleton
81. Bryndwr
82. Deans Bush
83. Holmwood

Heatchote County

84. Cashmere
85. Hillsborough
86. Valley

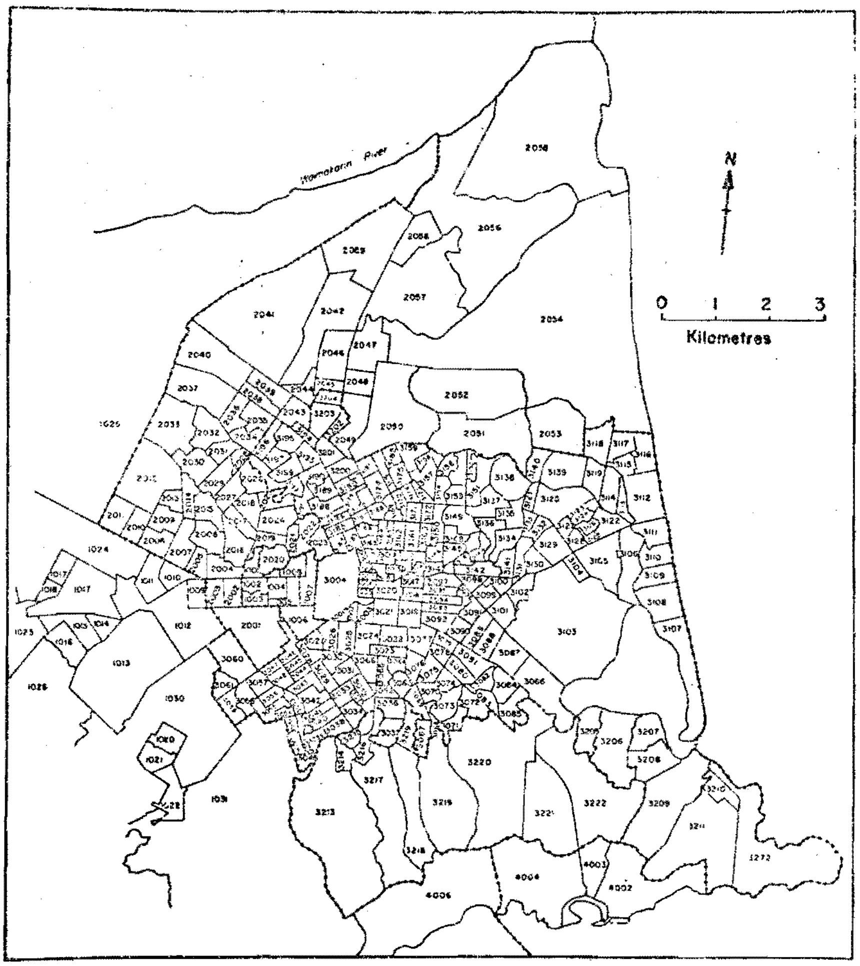


FIGURE 2.2 : CHRISTCHURCH URBAN AREA, 1971: CENSUS DISTRICTS

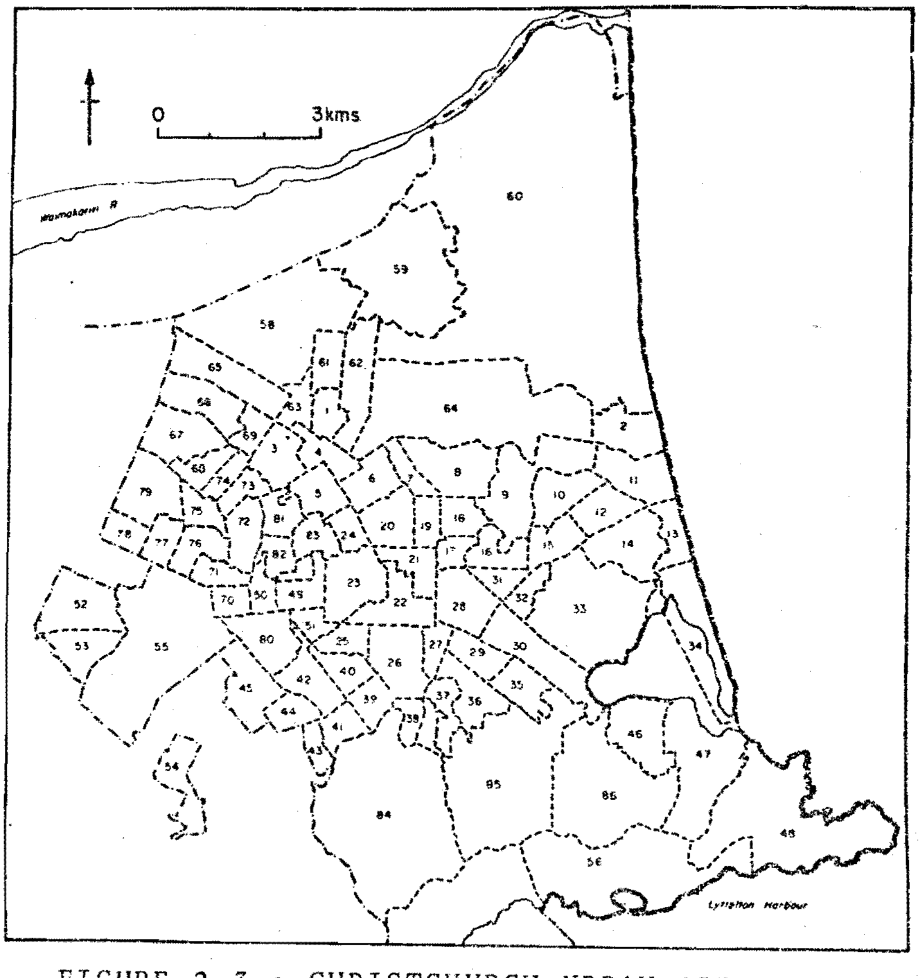


FIGURE 2.3 : CHRISTCHURCH URBAN AREA, 1971: CENSUS SUBDIVISIONS

TABLE 2.3

INTERCORRELATION MATRIX

SOCIAL AND DEMOGRAPHIC VARIABLES
(VARIABLES UNTRANSFORMED)

% 0-14 YEARS	100													
% 25-44 YEARS	73	100												
% 45-64 YEARS	-62	-65	100											
% OVER 65 YRS	-82	-72	56	100										
% NON-MAORI	-04	-05	23	10	100									
% NEV.MARR'D	-68	-55	11	40	-10	100								
% SEP,WID,DIV	-73	-64	44	86	-10	42	100							
% 1 FAM.HHOLD	84	61	-25	-71	16	-78	-74	100						
% OWN HOUSE	-39	-52	64	56	21	-05	34	-17	100					
% TABLE MORTG	83	75	-48	-72	18	-68	-74	85	-37	100				
% $6,000 +	-15	-14	24	19	33	09	-01	-04	28	-07	100			
% HOUSEWIVES	55	30	03	-24	12	-83	-30	69	27	52	07	100		
% PROFESSIONAL	-32	-24	10	29	25	43	11	-35	14	-21	73	-27	100	
% RENT	-59	-44	07	38	-37	72	57	-76	-26	-77	-22	-71	05	100

> similar sets of characteristics (Rummel, 1967). Both are necessary requisites in the present study. The decision to rotate component axes derives from a recognition that there is no general dimension of residential differentiation as would belie the acceptance of an unrotated solution. From a methodological point of view, it is generally recognised (Nunnally, 1967, p. 321) that rotation of axes results in a more interpretable set of components, and it is the meaningfulness of the dimensions which emerge from factor or component analyses that Cattell (1965, p. 207) argues should determine when and how to rotate. Both unrotated and rotated component solutions have been undertaken in the present study and the results from each will be compared at a later stage in the chapter.

Both orthogonal and oblique procedures are available for rotation to a 'simpler structure', but it is becoming apparent that the two approaches lead to essentially the same conclusion about the numbers and kinds of components inherent in a particular matrix of correlations (see, for example, Nunnally, 1967, p. 327; Hughes and Carey, 1972; Walter and Wirt, 1972; Davies and Lewis, 1973). On the strength of these studies, the more traditional (at least from a geographical point of view) orthogonal rotations are adopted, *a priori*, in the present study, although several oblique rotations will be undertaken to determine whether, in fact, there appears to be variation in results due to the adoption of a particular rotation scheme.

Dimensions of Social and Demographic Structure

The unrotated component loading matrix (Table 2.4) indicates the presence of three independent patterns of relationship in the social-demographic data. The largest pattern of relationships (accounting for almost 50 percent of total variance) is identified as a general family status dimension. The set of bi-polar loadings highlights associations among young, nuclear family, child-centred, mortgaged households, while at the other end of the continuum there is the clustering of renter groups which include never married, and separated, divorced and widowed persons. The second component adds a further dimension to the family status construct. Termed established family, this component groups the following variables: high income, home ownership, non-working wives and households in the middle and latter stages of the life cycle. The single segregation measure, percent Non-Maori, loads on this dimension. The communality of this variable (43) indicates that 57 percent of it is unrelated to the other 13 variables, a fact which is illustrated in Table 2.3. In the intercorrelation matrix, it is with the indices of socio-economic status that two of the highest correlations occur, suggesting an association of ethnic status with economic rather than family 'establishment'. The remaining component, which accounts for 12 percent of the total variation clearly identifies a socio-economic status dimension.

Unrotated principal axes analysis provides the best representation of the most general patterns of relationships among a social-demographic data set for the Christchurch urban area in 1971. But it is a three-dimensional structure

TABLE 2.4

URBAN SOCIAL STRUCTURE

CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% 0-14 YEARS	-94			89
% 25-44 YEARS	-82			76
% 45-64 YEARS	53	60		72
% OVER 65 YRS	84			83
% NEV.MAR.ADULT	77			86
% SEP,WID,DIV.	81			76
% 1 FAM.HHOLDS	-91			90
%TABLE MORTGAGE	-93			88
% HOUSEWIVES	-61	57		81
% RENTS	71	-62		89
% NON-MAORI		56		43
% OWN HOUSE		77		60
% $6,000 +		55	68	79
% PROFESSIONAL			81	86
CUM.% VARIANCE	48	68	80	
EIGENVALUE	6.66	2.76	1.78	

* UNROTATED PRINCIPAL COMPONENTS(PRINCIPAL AXES) ANALYSIS

VARIABLES UNTRANSFORMED

LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL

1. GENERAL FAMILY STATUS
2. ESTABLISHED FAMILY
3. SOCIO-ECONOMIC STATUS

where no separate segregation dimension has emerged; instead there is an indication of its alignment with socio-economic indicators - a tendency which is in line with several overseas studies.

From the unrotated solution we proceed to the varimax-rotated component pattern (Table 2.5) where there has been an attempt to achieve a simpler structure by shifting from general components involving all the variables to group components involving sets of variables. An additional reason for rotating the principal axes is that it produces invariant components (see Rummel, 1967, p. 475), thereby extending the generality of any component study as well as enabling comparative analyses to be undertaken.

A general family status dimension is less apparent in the rotated pattern of component loadings. The first component is one which is now termed <u>tenure status-life style</u> and is labelled in this fashion largely as a result of the following pairing of opposites, namely: rent-mortgage; and never married adult-one family households (and housewives). The second component has the entire battery of age variables, thereby defining a <u>youthfulness-old age</u> continuum, along which particular life cycle groupings may be located. The third dimension again defines <u>socio-economic status</u>, except in this case the minority variable is attached to an economic position - social status construct.

Social and Demographic Patterns

In mapping the component scores of the rotated dimensions a choropleth portrayal using unit variance intervals provides for a realistic description of the city's

TABLE 2.5

URBAN SOCIAL STRUCTURE
CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% HOUSEWIVES	-90			81
% 1 FAM.HHOLDS	-83			90
% NEV.MAR.ADULT	90			86
% RENTS	88			89
%TABLE MORTGAGE	-68	-64		88
% 0-14 YEARS	-62	-70		89
% 25-44 YEARS		-77		76
% 45-64 YEARS		83		72
% OVER 65 YRS		83		83
% SEP.WID.DIV.		72		76
% OWN HOUSE		82		80
% NON-MAORI			58	43
% $6,000 +			88	79
% PROFESSIONAL			85	86
CUM.% VARIANCE	34	65	80	
EIGENVALUE	6.66	2.74	1.78	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
VARIABLES UNTRANSFORMED
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL
1. LIFE CYCLE 1 - TENURE STATUS/LIFE STYLE
2. LIFE CYCLE 2 - YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

social and demographic pattern (see Pyle, 1970; Davies, 1973). The more youthful households (child-bearing and child-rearing stages of the family life cycle) occupy the outer suburbs, except in the southern section of the city and along the Port Hills (Figure 2.4). A concentration of older households in the inner suburbs tends to indicate that a majority of households 'age with their area', although at present there is no mobility data at hand to test this contention. Closer to the centre, the older population gives way to a more youthful group of residents. An inspection of Figure 2.5 indicates that a high proportion of this group are likely to be in rental accommodation. The most striking feature of this map is the spatial extent of owner-occupied dwellings. A number of factors contribute to this situation. The New Zealand ethos which encourages private ownership of land and dwelling is reinforced by the Government through the State Advances Corporation, one of the major sources of mortgage finance for families or individuals wishing to acquire their first home. In order to increase the nation's stock of housing, State Advances assigns priority to loans required for the construction of new dwellings. As most new residential subdivisions occupy outer locations, an explanation for the co-location of young families in recently-built, mortgaged suburban property is apparent.

High status residential development is largely confined to two sections of the city - the northwest sector and the Port Hills, although recent years have seen the emergence of moderate-to-high status housing in the south-west (see Figure 2.6). Areas at the opposite end of the status scale

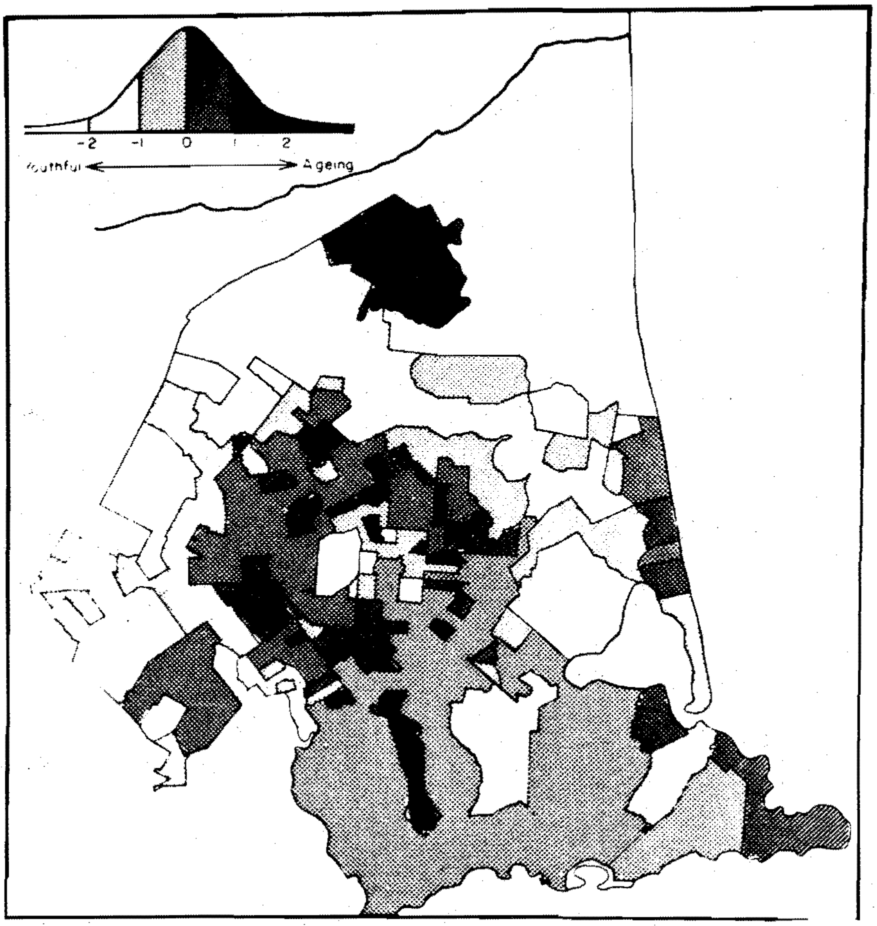


FIGURE 2.4 : CHRISTCHURCH : YOUTHFULNESS - OLD AGE/STAGE IN THE LIFE CYCLE

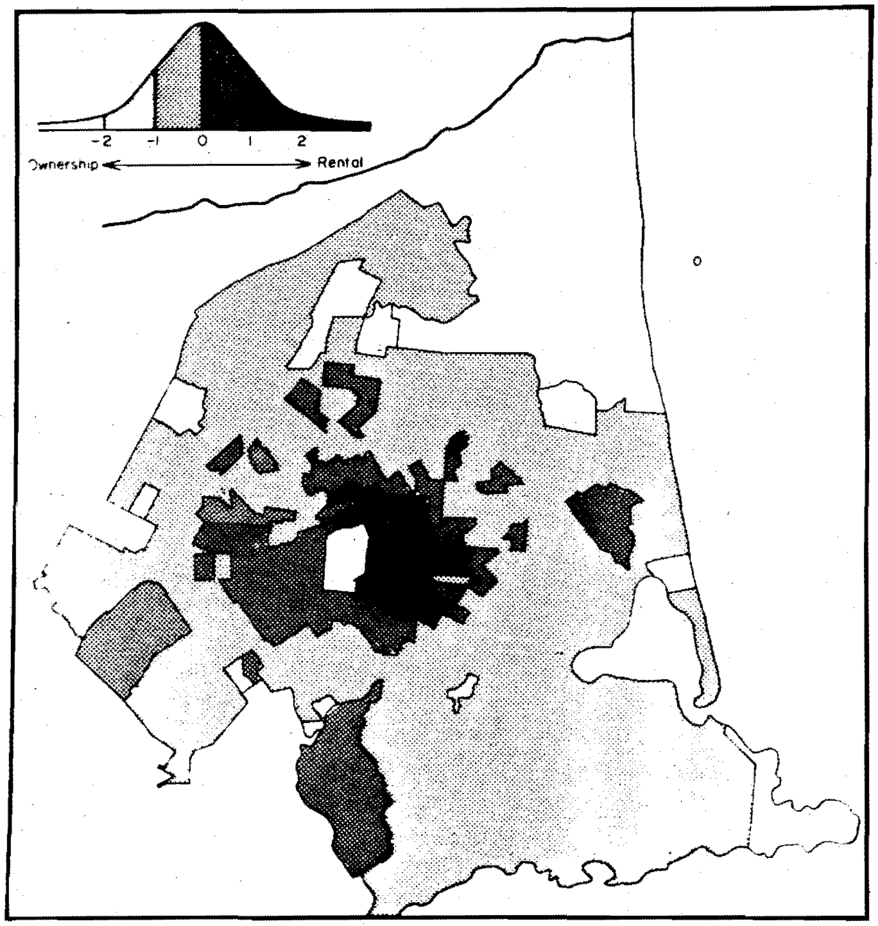


FIGURE 2.5 : CHRISTCHURCH : TENURE STATUS/ LIFE STYLE

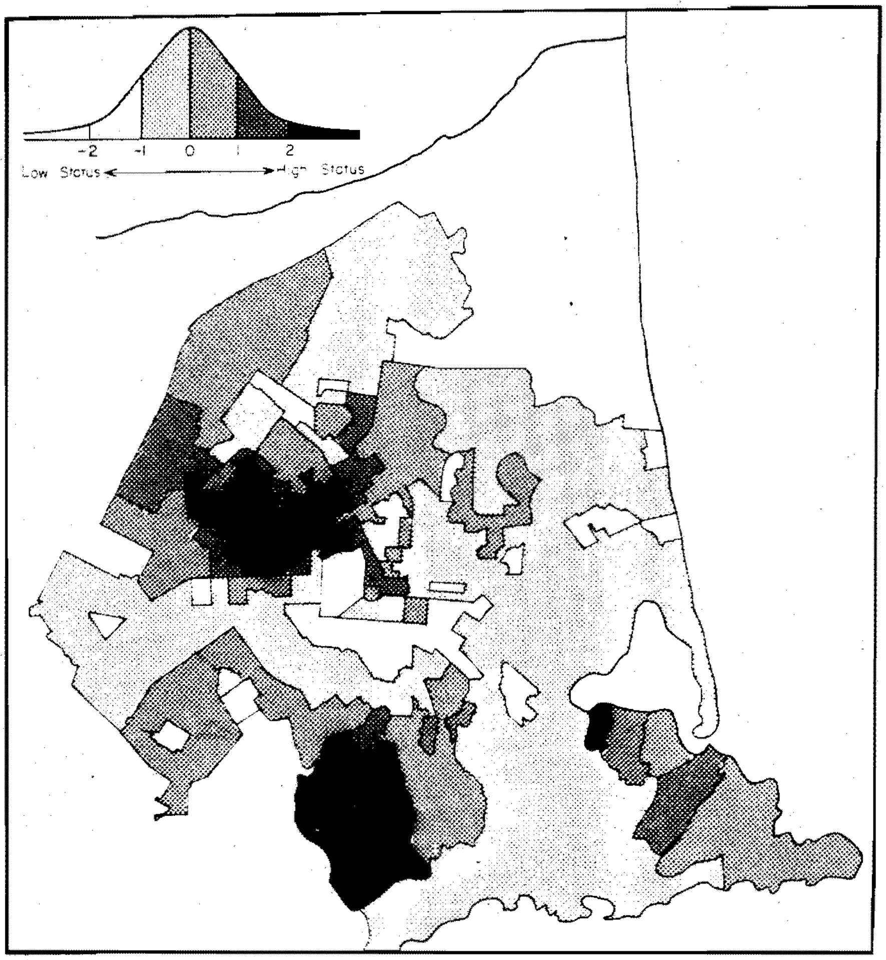


FIGURE 2.6 : CHRISTCHURCH : SOCIO-ECONOMIC STATUS

form a broad band around the south and east of the city, encompassing both the industrial areas of Hornby, Sockburn, Addington, Sydenham, Waltham, and Woolston and the State housing areas of Aranui and Bromley.

INVARIANCE OF THE SOCIAL AND DEMOGRAPHIC STRUCTURE AND PATTERN

The validity of any results from a principal components or factor analysis rest with the extent to which component or factor structures and patterns remain invariant. A condition of factorial invariance is a particularly important requirement when a study is using the results from factor or component analyses as the input for higher level analyses, studies of contextual position or the modelling of urban structure - individual behaviour relationships (ref: locational choice models in Part B). The present section seeks to determine whether the varimax-rotated principal axes solution is sufficiently invariant to be considered as the sole factor model for representing Christchurch's social and demographic structure.

Invariance Under Selection of Variables

Janson (1969, p. 327) indicates that when new variables are added to an existing set of variables, they create possibilities for additional dimensions (the converse is also likely; i.e. fewer variables - fewer dimensions). Where there is mainly an exchange or addition of equivalent variables, the substantive results should be much the same, though more detailed in the case of an enlarged matrix. Several published studies (Schmid and Tagashira, 1964; Sweetser, 1965a; Jolliffe, 1972) in fact point to a considerable invariance between analyses of parallel sets of variables of various sizes.

A varimax rotated principal axes analysis of the initial 33 variable set generated six components which explained 80 percent of total variation among the data. The first three dimensions (60 percent explained variation) remain in the 14 variable analyses. The fourth component (10 percent explain variation) was a student dimension (high loadings on never married, income less than $1,800, 15-19 years of age, student occupation); while the remaining two components could not be successfully labelled. In the present situation, therefore, variable reduction has not undermined the representation of the major dimensions of Christchurch's social and demographic structure.

Invariance Between Methods of Computation

The emergence of 'duplicate' studies of the same city which have produced results in some respects at variance with each other, has prompted claims that the substantive findings reported by factor ecological studies may need to be revised because they are method-dependent (Hunter, 1972; Rees, 1972; Davies, 1973). The variety of initial and derived solutions available to the research worker presents an awesome number of combinations if all methods are to be exhausted and their results compared. For this reason attention will be restricted to:

1) the problem of communality estimates: principal components (unities) vs. image analysis (squared multiple correlations), and
2) the question of orthogonal (varimax criterion) vs. oblique (direct oblimin) rotation.

Although the number of dimensions to extract (and rotate) in a particular analysis remains an important issue (Veldman, 1974) it was decided to adopt the most widely used rule (Kaiser, 1958) that only principal axes with eigenvalues (sums of squared loadings) exceeding 1.0 be extracted and rotated. This means that a component must account for a greater proportion of the variance than any one of the original variables.

1) Communalities

The values placed into the principal diagonal of the correlation matrix prior to factoring (the communalities) serve to distinguish two of the major approaches in factor analysis. The principal axes method employed earlier is based on the assumption that all of the variation contained in the correlation matrix is worthy of consideration in deriving component dimensions from the original variables. In this closed model unities are placed in the main diagonal. Factor models on the other hand accept perhaps more realistically that there are exogenous variables influencing those in the matrix - the value to be placed in the principal diagonal is consequently less than one. There have been many communality estimates proposed (Harman, 1960) the most common being the square of the multiple correlation of each variable with all the others. In applying image analysis (a technique which places R^2 in the principal diagonal) to the matrix of social and demographic variables, opportunity is given to assess the influence of open versus closed models on component structure and pattern.

Although Rees' (1972) comparison of two Montreal studies may suggest otherwise, more recent studies by Haynes (1971) and Clark (1972b) point to a general invariance in results when unities and R^2 are used as communality estimates. Rees would appear to be ignoring his own dictum,

> *Only exact comparability of inputs is sufficient for the exact comparison of outputs. (Rees, 1972, p. 289.)*

when comparing the two Montreal studies - the number of areal units and the number (and type) of variables used in both studies differ.

In the Christchurch example, an image analysis of the 14 social and demographic variables used in principal axes analyses produced an almost identical component structure to that of the latter (Table 2.6). To obtain a more objective assessment of factorial invariance between the two analyses, the factor loadings from each analysis are compared via program RELATE (Veldman, 1967). This method determines analytically the degree of rotation of the component axes of one of the structures required to provide maximum overlap with the corresponding structure. The degree of rotation necessary to achieve this criterion is expressed as a matrix of cosines of the angles between all pairs of component axes in the two structures. The principal axes/image analysis component structures display considerable invariance (Table 2.7, section A/D), as do the component scores from the two analyses (Table 2.8, section A/C). The only noticeable difference between the two analyses concerns the ethnic variable, percent Non-Maori, which fails to load highly on any dimension (its highest loading is 44 on the socio-economic status dimension). Veldman (1967, p. 219)

TABLE 2.6

URBAN SOCIAL STRUCTURE

CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% HOUSEWIVES	-86			73
% 1 FAM.HHOLDS	-81			87
% NEV.MAR.ADULT	86			80
% RENT	88			89
%TARLE MORTGAGE	-69	-65		89
% 0-14 YEARS	-62	-69		88
% 25-44 YEARS		-72		69
% 45-64 YEARS		78		64
% OVER 65 YRS		82		81
% SEP,WID,DIV.		70		72
% OWN HOUSE		81		81
% $6,000 +			78	62
% PROFESSIONAL			75	67
% NON-MAORI				26
CUM.% VARIANCE	32	62	74	
EIGENVALUE	6.47	2.47	1.34	

* VARIMAX ROTATED IMAGE ANALYSIS
VARIABLES UNTRANSFORMED
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL

1. LIFE CYCLE 1 - TENURE STATUS/LIFE STYLE
2. LIFE CYCLE 2 - YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

TABLE 2.7

URBAN SOCIAL STRUCTURE

CHRISTCHURCH 1971

STABILITY OF DIMENSIONS

COSINES AMONG COMPONENT AXES

		B		
		1.	2.	3.
	1.	99	11	05
A	2.	-11	99	-03
	3.	06	-02	-99

		C		
		1.	2.	3.
	1.	99	01	04
B	2.	-01	99	-02
	3.	04	-02	-99

		C		
	1.	99	12	01
A	2.	-12	99	-01
	3.	-01	01	99

		D		
	1.	99	-11	06
B	2.	11	99	00
	3.	06	-01	-99

		D		
	1.	99	00	-01
A	2.	00	99	-02
	3.	01	02	99

		E		
	1.	99	00	-01
B	2.	00	99	02
	3.	01	02	99

		E		
	1.	99	-11	-07
A	2.	11	99	04
	3.	07	-05	99

		F		
	1.	99	02	05
B	2.	-02	99	-03
	3.	05	-03	-99

		F		
	1.	99	12	00
A	2.	-12	99	00
	3.	00	00	99

		E		
	1.	99	-11	-06
D	2.	11	99	02
	3.	07	-03	99

		D		
	1.	99	12	02
C	2.	-12	99	01
	3.	-02	-01	99

		F		
	1.	99	13	01
D	2.	-13	99	02
	3.	-01	-02	99

		E		
	1.	99	01	-05
C	2.	-01	99	03
	3.	05	-03	99

		F		
	1.	99	02	-06
E	2.	-01	99	04
	3.	06	-04	99

		F		
	1.	99	01	-01
C	2.	-01	99	01
	3.	01	-01	99

A = PRINCIPAL COMPONENTS ANALYSIS
UNTRANSFORMED VARIABLES
B = PRINCIPAL COMPONENTS ANALYSIS
BLANKET LOG 10 TRANSFORMED VARIABLES
C = PRINCIPAL COMPONENTS ANALYSIS
INDIVIDUALLY TRANSFORMED VARIABLES
D = IMAGE ANALYSIS
UNTRANSFORMED VARIABLES
E = IMAGE ANALYSIS
BLANKET LOG 10 TRANSFORMED VARIABLES
F = IMAGE ANALYSIS
INDIVIDUALLY TRANSFORMED VARIABLES
1 = LIFE CYCLE 1
2 = LIFE CYCLE 2
3 = SOCIO-ECONOMIC STATUS

TABLE 2.8

CORRELATIONS BETWEEN

COMPONENT SCORES

1A	100																	
2	00	100																
3	00	00	100															
1B	97	09	07	100														
2	-05	96	00	00	100													
3	09	01	-89	00	00	100												
1C	99	00	01	97	-05	08	100											
2	00	99	-03	09	95	03	00	100										
3	00	03	97	08	02	-86	00	00	100									
1D	98	15	01	97	10	08	98	15	01	100								
2	-14	98	-01	-06	96	00	-15	98	03	00	100							
3	00	01	97	08	-01	-91	00	-03	98	00	-01	100						
1E	99	14	01	98	09	08	98	15	02	99	00	01	100					
2	-15	99	00	-06	97	-01	-14	98	02	01	99	-01	00	100				
3	-01	00	99	06	00	-94	00	-04	96	00	-01	98	00	00	100			
1F	97	09	08	99	00	-02	97	09	09	97	-05	10	97	-05	08	100		
2	-05	95	-04	00	99	04	-05	94	-02	10	95	-06	09	95	-04	00	100	
3	-12	01	87	-03	02	-98	-12	-01	86	-11	03	91	-11	03	91	-01	-01	100

A = PRINCIPAL COMPONENTS ANALYSI S - UNTRANSFORMED VARIABLE S
B = PRINCIPAL COMPONENTS ANALYSI S - BLANKET LOG10 TRANSFORM ED VAR.
C = IMAGE ANALYSIS - UNTRANSFOR MED VARIABLES
D = IMAGE ANALYSIS - INDIVIDUAL LY TRANSFORMED VARIABLES
E = PRINCIPAL COMPONENTS ANALYSI S - INDIVIDUALLY TRANSFORMED VA RIABLES
F = IMAGE ANALYSIS - BLANKET LOG 10 TRANSFORMED VARIABLES

1 = LIFE CYCLE 1

2 = LIFE CYCLE 2

3 = SOCIO-ECONOMIC STAT US

would argue that this is due to the fact that image analysis is most suited to problems where each of the important factors is represented by more than one variable. Certain component or factor analyses - such as the present analysis - involve data where an important factor is represented by only one of the original variables. An image analysis of such data could not register such a factor, since most of its variation would not be shared by other variables in the set (for instance, the communality of 26 for percent Non-Maori).

2) Orthogonal vs. Oblique Rotation

The rationale for rotation rests simply on the aid it may provide in the interpretation of factors - to achieve a more parsimonious structure. The orthogonal rotation employed thus far introduces a constraint in the search for the actual dimensions of residential structure. For instance, if the dimensions are in fact correlated, the varimax rotated principal axes solution may erroneously make it appear that there are independent dimensions where none exist. As there would appear to be little use in generating locational choice models which are based on non-independent, correlated dimensions, oblique rotation is undertaken to detect the presence of correlated factors.

The method employed here to obtain an oblique 'simple structure' solution is the direct oblimin approach of Jennrich and Harman, a procedure which has superceded earlier oblique solutions and has found its way into several geographic analyses (Semple, 1968, 1969; King and Jeffrey, 1972; Parkes, 1973; Davies and Barrow, 1973: Johnston, 1974a)[7]. The direct oblimin program has as its input the component loadings of the orthogonal principal axes analysis. The output is a new set of correlated dimensions of social and demographic structure. The complete solution consists of a matrix of pattern loadings, indicating which variables are highly involved in which clusters; a matrix of structure loadings which measure the correlation of variables with the dimension; and a matrix of factor correlations indicating the correlation between the factors (Table 2.9). Reference to the oblique factor pattern indicates a set of dimensions almost identical to that of the principal axes solution. Figures for percent of total variance are not given for the oblique factors, but an indication of the strength of the separate oblique factor patterns may be gained by summing the columns of squared factor loadings. Values of 4.1, 4.4 and 2.1 (all having been divided by 10^3 to reduce them to their original metric) signify a greater equality between the two family status dimensions than previously indicated, while the position of the socio-economic status dimension remains fundamentally the same. The factor correlations between the oblique factors indicate that socio-economic status is in fact orthogonal with the tenure status - life style dimension (factor 1) and the stage in life cycle dimension (factor 2). The tenure status-life style pattern does have some positive relationship to the stage in life cycle pattern, however. With the analyses undertaken thus far, it would seem as though the two family status dimensions possess sufficient identity to be considered as separate, though not necessarilv unrelated dimensions.

TABLE 2.9

ORLIMIN ROTATION OF COMPONENT
ANALYSIS *

VARIABLE	1. ROTATED COMPONENT PATTERN 1.	2.	3.	2. ROTATED COMPONENT S TRUCTURE 1.	2.	3 .
% 0-14 YEARS	-48	-69	-07	-65	-82	-1 5
% 25-44 YEARS	-23	-77	-03	-42	-84	-1 4
% 45-64 YEARS	-23	85	08	-02	81	2 3
% OVER 65 YRS	19	83	06	39	89	1 8
% NON-MAORI	-27	11	57	-29	13	6 1
% NEV.MAR.ADULTS	89	08	19	90	33	1 4
% SEP.WID.DIV.	31	74	-20	51	79	-1 1
% 1 FAMILY HHOLDS	-74	-42	00	-85	-61	-0 1
% OWN HOUSE	-45	84	14	-25	76	3 1
% TABLE MORTGAGE	-54	-64	09	-71	-76	0 4
% >$6000	02	05	88	-04	19	8 9
% HOUSEWIVES	-93	12	-07	-89	-12	0 1
% PROFESSIONAL	42	-06	87	34	18	8 3
% RENTS	84	15	-30	89	31	-3 4

3. COMPONENT CORRELATIONS

1.	100		
2.	25	100	
3.	-07	15	100

* BASED ON A VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYS IS (VARIABLES UNTRANSFORMED)

1. TENURE STATUS/LIFE STYLE
2. YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

DELTA =0.0

EPSILON =0.000010

The Effect of Relaxing the Assumptions Required by Pearsonian Correlation Analysis

In principal components or factor analytic models which use the product moment correlation coefficient as the measure of association between variables[8], several assumptions relating to the nature of the input data need to be satisfied. These assumptions, together with techniques for detecting the presence of data which is at variance with the assumptions, are outlined by Minium (1970), and within a geographic context by Poole and O'Farrell (1971) and Yeates (1974).

They are:

1) linearity. The extent to which a straight line relationship provides the best fit to a bivaraite distribution can be gauged by inspecting a scatter diagram (preferably in conjunction with the regression lines and the correlation coefficient).

2) homoscedasticity. To determine the extent to which there is equal variability in both variables of a bivariate relationship (homogeneity of variance); recourse can again be made to the scatter diagrams.

3) the shape of the distributions. If the correlation coefficient is to be calculated purely as a descriptive measure, there is no requirement that the distributions of each variable be normal. Minium (1970, p. 160) does warn, however, that if one or both variables in a bivariate relationship have skewed distributions, they may also be curvilinearly related. Therefore, when the distributions are not symmetrical, it is desirable to examine the data to determine the correctness of the linear hypothesis. Measures of skewness and kurtosis assist in such an assessment (see McNemar, 1966).

4) <u>multicollinearity</u> (considered earlier in the chapter).

Scatter diagrams for all combinations of the 14 variables (Appendix II.1) revealed that although there were a number of bivariate relationships which may be considered heteroscedastic, most of the 91 relationships were linear (the variables percent non-Maori, housewives and never married adults would appear to be the main deviants). The influence of extreme values on correlation coefficients was also apparent - a situation which may be rectified by compressing the range in the data via transformation. It was apparent that those variables exhibiting the greatest departure from normality (see Table 2.10) combine in some instances with other variables to produce relationships which depart from an idealised linear form.

Clark (1973) has recently examined the influence that a transformation of the variables (both individual and blanket) has on the output from principal component analyses. Little mention is made of any influence on composite structure (loadings), most change occurring with respect to the component scores - although no explanation is advanced for this effect.

The principal axes and image analyses undertaken on individually transformed and blanket log 10 transformed social-demographic data reveal component and factor structures (Tables 2.11 to 2.14) which have a high level of stability when compared with the untransformed principal axes solution (Table 2.7). The degree of congruence is not quite as high when attention is shifted to the pattern of component

TABLE 2.10

TRANSFORMATION OF 1971 CENSUS VARIABLES

TO APPROXIMATE NEAR-NORMAL DISTRIBUTION.

VARIABLE	NATURE OF TRANSFORMATION						
	NO TRANSF.	SQUARE ROOT	LOG 10	NATURAL LOG	SINE	LOG/LOG	RECIP-ROCAL
1.%0-14 YEARS *	0.48	-4.50	-13.43	-13.43	0.66	-16.76	45.63
**	-1.27	3.40	22.69	22.69	-5.50	39.93	175.09
2.%25-44 YEARS	4.79	3.18	1.40	1.40	0.53	0.71	2.92
	-0.98	-1.46	-1.36	-1.36	-5.27	-1.12	1.75
3.%45-64 YEARS	-2.20	-5.79	-10.46	-10.46	0.31	-13.03	31.92
	0.26	2.43	11.13	11.13	-5.31	18.90	117.11
4.% OVER 65 YRS	1.76	-2.64	-10.43	-10.43	-0.43	-50.69	114.54
	-1.59	-2.09	13.67	13.67	-5.31	298.81	962.35
5.%NON-MAORI	-22.82	-23.77	-24.75	-24.83	8.36	-25.18	26.95
	55.52	60.77	61.13	75.19	2.52	98.73	77.46
6.%NEV.MARR'D AD.	12.76	7.41	1.52	1.52	-0.91	-0.60	14.92
	16.52	8.47	6.28	6.29	-5.18	7.61	39.52
7.%SEP.WID.DIV.	3.00	-1.01	-6.21	-6.21	0.47	-9.72	32.21
	-0.54	-0.91	4.42	4.42	-5.34	12.65	124.72
8.% 1 FAM.HHOLDS	-6.93	-9.55	-12.70	-12.70	-0.09	-13.80	20.64
	2.14	6.27	12.66	12.66	-5.53	15.27	35.30
9.% RENT	7.52	2.70	-3.14	-3.14	0.76	-5.77	17.19
	1.35	-2.35	-1.71	-1.71	-5.03	0.51	22.29
10.% OWN	-1.74	-5.76	-13.01	-13.01	0.11	-18.52	48.08
	-3.01	0.18	14.87	14.87	-5.60	33.07	187.79
11.%TABLE MORTGAGE	2.96	-3.73	-19.87	-19.87	-0.25	-37.15	42.64
	-2.08	0.31	32.87	32.87	-5.53	97.33	120.02
12.% $6,000 +	14.81	6.12	-8.85	-8.85	-1.04	-18.69	20.43
	15.00	2.61	5.78	5.78	-5.03	19.08	21.99
13.% HOUSEWIVES	-13.26	-18.09	-24.80	-24.80	0.37	-27.61	46.64
	17.87	32.29	59.95	59.95	-5.24	74.04	198.66
14.% PROFESSIONAL	8.78	3.21	-9.03	-9.03	0.79	-61.88	120.16
	5.38	6.10	22.62	22.62	-5.43	408.28	985.73

* SKEWNESS

** KURTOSIS

TABLE 2.11

URBAN SOCIAL STRUCTURE

CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% 0-14 YEARS	-81			79
% 1 FAM.HHOLDS	-91			89
% HOUSEWIVES	-89			82
%TABLE MORTGAGE	-90			82
% NEV.MAR.ADULT	83			79
% RENT	70			79
% 25-44 YEARS		-72		72
% 45-64 YEARS		87		78
% OVER 65 YRS		85		92
% SEP/WID/DIV.		77		81
% OWN HOUSE		79		75
% NON-MAORI			-68	52
% $6,000 +			-83	70
% PROFESSIONAL			-81	78
CUM.% VARIANCE	36	62	78	
EIGENVALUE	6.32	2.84	1.71	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
VARIABLES BLANKET LOG10 TRANSFORMED
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL

1. LIFE CYCLE 1 - TENURE STATUS/LIFE STYLE
2. LIFE CYCLE 2 - YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

TABLE 2.12

URBAN SOCIAL STRUCTURE

CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% HOUSEWIVES	-88			82
% 1 FAM.HHOLDS	-89			89
% NEV.MAR.ADULT	86			80
% RENTS	86			88
% 0-14 YEARS	-71	-60		88
% 25-44 YEARS	-52	-66		71
% SEP,WID,DIV	56	68		79
%TABLE MORTGAGE	-77	-54		89
% 45-64 YEARS		84		73
% OVER 65 YRS		76		82
% OWN HOUSE		84		78
% NON-MAORI			51	46
% $6,000 +			89	81
% PROFESSIONAL			84	84
CUM.% VARIANCE	37	64	79	
EIGENVALUE	6.78	2.60	1.73	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
VARIABLES INDIVIDUALLY TRANSFORMED TO NEAR-NORMAL
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL

1. LIFE CYCLE 1 - TENURE STATUS/LIFE STYLE
2. LIFE CYCLE 2 - YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

TABLE 2.13

URBAN SOCIAL STRUCTURE
CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% 0-14 YEARS	-79			77
% 1 FAM.HHOLDS	-89			84
% HOUSEWIVES	-84			72
%TABLE MORTGAGE	-86			77
% NEV.MAR.ADULT	79			71
% RENTS	66			71
% 25-44 YEARS		-66		63
% 45-64 YEARS		79		66
% OVER 65 YRS		83		88
% SEP,WID,DIV.		77		81
% OWN HOUSE		72		65
% NON-MAORI			53	33
% $6,000 +			63	41
% PROFESSIONAL			67	56
CUM.% VARIANCE	33	57	68	
EIGENVALUE	5.99	2.36	1.09	

* VARIMAX ROTATED IMAGE ANALYSIS
VARIABLES BLANKET LOG 10 TRANSFORMED
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL
1. LIFE CYCLE 1 - TENURE STATUS/LIFE STYLE
2. LIFE CYCLE 2 - YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

TABLE 2.14

URBAN SOCIAL STRUCTURE
CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% HOUSEWIVES	-83			72
% 1 FAM.HHOLDS	-87			86
% NEV.MAR.ADULT	82			73
% RENTS	85			86
% 0-14 YEARS	-71	-59		87
% 25-44 YEARS	-51	-61		64
%TABLE MORTGAGE	-78	-52		89
% SEP.WID.DIV.	56	65		76
% 45-64 YEARS		78		63
% OVER 65 YRS		75		80
% OWN HOUSE		80		73
% $6,000 +			76	60
% PROFESSIONAL			74	66
% NON-MAORI				27
CUM.% VARIANCE	35	60	72	
EIGENVALUE	6.55	2.21	1.27	

* VARIMAX ROTATED IMAGE ANALYSIS
VARIABLES INDIVIDUALLY TRANSFORMED TO NEAR-NORMAL
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL
1. LIFE CYCLE 1 - TENURE STATUS/LIFE STYLE
2. LIFE CYCLE 2 - YOUTHFULNESS/OLD AGE
3. SOCIO-ECONOMIC STATUS

scores (Table 2.8). Irrespective of the type of transformation undertaken, the component scores of the two family status dimensions maintain close parity with scores from the 'untransformed analysis'. Scores on the socio-economic status dimension do exhibit variation, particularly when the data is blanket log 10 transformed. In an effort to determine which areas were most affected by data transformation, socio-economic status component scores from the untransformed and blanket log 10 principal axes analyses were ranked. The change in an area's rank position on the socio-economic status dimension is presented in Figure 2.7. Most areas experienced a change in rank of between 0 and 39 positions, which is tantamount to no change, given the large number of tied component scores (the distribution of scores in both analyses being highly symmetric).

Areas of greatest change in status position are typically those with an institutional population (thereby providing a higher than normal proportion of residents in a particular age, sex, occupational, income, etc. category). This is not the case in all areas however. Certain state housing blocks are also highlighted, as are some of the newly developed suburbs. A log transformation of the variables will have the effect of bunching together the extremely large scores and consequently lessening the effect that they will have on an inflation of the component score (a component score for an area being derived by the sum of the component weight-times-data products for all the variables). If the research worker wishes to reduce the influence of extreme values on his analyses, data transformation is to be preferred to wholesale removal of an area from

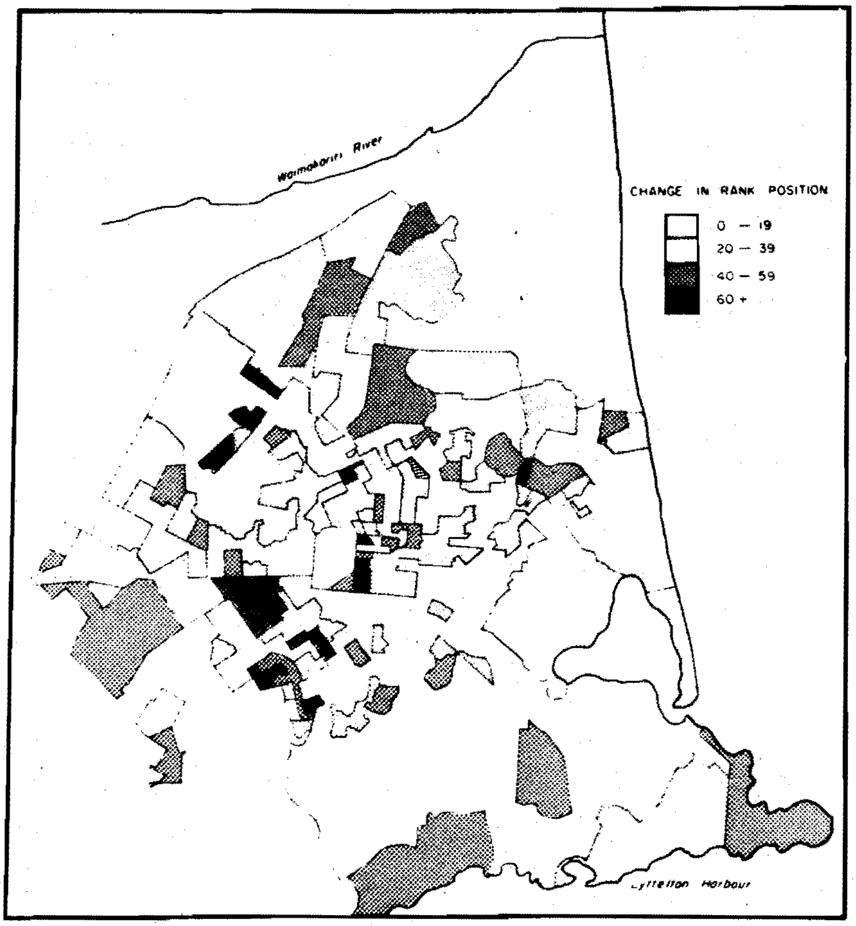


FIGURE 2.7 : CHANGE IN RANK POSITION OF COMPONENT SCORES DUE TO TRANSFORMATION (SOCIO-ECONOMIC STATUS DIMENSION)

consideration (as is sometimes advocated). After all, such areas are highly characteristic of an urban system. They are retained in the present analyses.

Spatial Scale

While the problems of cross-level inference are well-recognised within the geographic literature, uncertainties still exist regarding the effects of spatial scale and data aggregation on the reliability of statistical techniques used to examine spatial data. Yule and Kendall (1950) and Robinson (1956) were among the first to draw attention to the effects of scale on the correlation coefficient. In a further study, Blalock (1961, p.99) is of the opinion that the results of the aggregation procedure on correlation coefficients are nearly impossible to predict. He argues that by shifting units we may be affecting the degree to which other unknown or unmeasured variables are influencing the situation. From a geographic standpoint it has been argued that different processes operate at different spatial scales (Harvey, 1969), and as a consequence variation in relationships measured at different levels will occur. For the most part this is a proposition awaiting confirmation.

In studying correlates of social disorganisation in Syracuse, Sawiki (1973) found that ecological correlations at one level of analysis could not be substituted for correlations at other levels. The three levels chosen for study were: police beats (smallest unit), 'neighbourhoods', and census tracts (largest unit). Not only did the correlation coefficients vary between levels, but in some cases changed sign - and not in any apparent systematic manner.

Openshaw (1973) set out explicitly to study the effect of scale on principal component studies, by choosing 6 housing indicants (all pertaining to the age of the dwelling), and allocating data on these indicants to a range of grids from 100 metres to one kilometer square. The raw data generally underwent a progressive increase in mean values and standard deviations as scale increased, skewness also being reduced. Clearly the areal units were becoming more heterogenous although no comment is made to this effect. In testing for variation in the product moment correlation coefficient, Z-tests suggested that 74 percent of all comparisons were not significantly different at the 0.10 level. When the six variables were subjected to principal components analysis, component loadings on the principal dimension were found to vary across scales. As Openshaw's study was restricted to one variable (with six categories) it would seem necessary to extend the problem to a set of variables more representative of the usual factorial ecology.

Aggregation of Christchurch's census district data to the subdivision level provides a basis for examining the influence of scale in principal components analysis. There was negligible change in means and standard deviations. In general the size of correlations increased at the subdivision scale of analysis, reflecting, as in Openshaw's study, a trend towards increasing generalisation of spatial associations at larger scales.

A varimax-rotated principal axes analysis of the 14 social and demographic variables at the subdivision scale is presented in Table 2.15. A three-dimensional structure again emerges, one which exhibits a high degree of stability (Table 2.16). One interesting point emerges, and this concerns the alignment of the sole ethnic variable with the tenure status - life style dimension when the analysis is undertaken at the subdivision level. This result is in line with the earlier study of Timms (1970a), who also used subdivision data in his analyses. In view of the clearly defined differences between Maori and Pakeha (European) in terms of occupation, education, status and income (see Forster and Ramsay, 1969), the loading of the ethnic indicant on the socio-economic status rather than family status dimension would appear more in line with the current position of the Maori within the structure of New Zealand's urban society.

SUMMARY

Fourteen indicants of household social and demographic status have been reduced via varimax-rotated principal axes analysis to three basic dimensions of social and demographic structure. These are, <u>tenure status - life style</u>, <u>youthfulness - old age</u> (stage in the life cycle) and <u>socio-economic status</u>.

The invariance of this particular component solution was examined in view of the need for a more critical approach in the application of factor analysis in geographical studies (see Clark et. al., 1974 for a recent statement on this issue). This is especially important when the results from factor analyses form the basis for higher level analyses or model-building.

TABLE 2.15

URBAN SOCIAL STRUCTURE

CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
% 25-44 YEARS	-83			85
% 45-64 YEARS	84			89
% OVER 65 YRS	90			93
% SEP.WID.DIV	84			86
% OWN HOUSE	91			92
% 1 FAM.HHOLDS	-58	-74		92
% 0-14 YEARS	-80	-53		95
% TABLE MORTG.	-77	-59		94
% NON-MAORI		-67		68
% NEV.MAR.ADULT		78		83
% HOUSEWIVES		-80		85
% RENTS		91		92
% $6,000 +			91	85
% PROFESSIONAL			96	95
CUM.% VARIANCE	41	72	88	
EIGENVALUE	8.44	2.55	1.36	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
AGGREGATED CENSUS DISTRICT DATA (I.E.SUBDIVISIONS)
VARIABLES UNTRANSFORMED
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL
1. LIFE CYCLE 1 - STAGES IN LIFE CYCLE
2. LIFE CYCLE 2 - TENURE STATUS/LIFE STYLE
3. SOCIO-ECONOMIC STATUS

TABLE 2.16

URBAN SOCIAL STRUCTURE
CHRISTCHURCH 1971
STABILITY OF DIMENSIONS AT DIFFERENT SPATIAL SCALES

COSINES AMONG COMPONENT AXES

SUBDIVISION SCALE

		1.	2.	3.
CENSUS DISTRICT SCALE	1.	97	10	20
	2.	-09	99	-04
	3.	-20	02	98

1. = LIFE CYCLE 1
2. = LIFE CYCLE 2
3. = SOCIO-ECONOMIC STATUS

Stability of component structure and pattern were examined in a number of different contexts: variable reduction, communalities, rotation, distributional characteristics of the variables and spatial scale. In general, the findings would appear to confirm the robust nature of the orthogonal principal components model (also, see Nunnally, 1967). As far as the present study is concerned, varimax-rotated image analyses and an oblique rotation of the principal axes structure all led to essentially the same conclusion about the numbers and kinds of dimensions inherent in the social and demographic characteristics of Christchurch's population.

There were two areas in which a certain amount of variation could be detected, however. The first of these related to the effect of relaxing the requirements of Pearsonian correlation analysis. Transformation of the original data, in an effort to improve linearity and reduce skewness, had little effect on the component structure, most change occurring in the pattern of component scores. The amount of change, however, was judged to be within acceptable limits for all but a few of Christchurch's residential subdistricts.

The second area in which a certain amount of variation occurred involved the spatial scale at which analyses were undertaken. Although a high degree of congruence existed between the component structures derived at the census district and subdivision scales, correlation coefficients tended to increase as the size of the areal unit increased, suggesting a trend towards greater generalization of spatial associations at larger scales. A more serious problem is one where the sign of the coefficients change from one level of analysis to another, suggesting a shift in the set of inter-relationships among the variables chosen for analysis. This was not found to be the case in the present study.

The findings of the present chapter suggest that the orthogonal principal axes model is valid for the type of spatial analyses to be undertaken in Chapters 2 through 5. Oblique rotations are needed, however, to establish the existence of any relationship between the major structural dimensions.

The major dimensions outlined above provide a realistic basis for a typology and a regionalisation of the residential subareas of Christchurch in terms of the attributes of the resident populations. To the extent that households desire to live in close proximity to households with similar characteristics, we can expect that a subarea's position on the social status or life cycle scale is likely to have a bearing on the type of household attracted to that area. For this reason, the three dimensions of tenure status - life style, stage in life cycle and socio-economic status provide a basis for the locational choice models to be established in Part B.

NOTES

1 Examples of the former include population mobility (Janson, 1974; Timms, 1971), density (Janson, 1974; Parkes, 1973), cosmopolitanism (Badcock, 1973) and suburbanisation (Murdie, 1969). Studies where there has been a 'disintegration' of a major dimension into a number of sub-dimensions include those of Sweetser (1965b) with 'progeniture', 'established familism' and Anderson and Bean (1961) with 'life style' and 'family composition' (all of a family status/life cycle genre); while Parkes' (1973) study of Newcastle suggested the possibility of two social status dimensions, as did Davies and Barrow's (1973) Canadian study. A variety of segregation dimensions have emerged, reflecting the role that various immigrant groups have played in the economic and social life of cities and the extent to which the groups have assimilated into the host society (see Thomson and Trlin (1970) for some New Zealand examples).

2 An excellent survey of current problems can be found in: Multivariate Analysis in Geography, Working Paper Set No. 1, I.B.G., Study Group in Quantitative Methods, 1973, 45 pp.

3 Both studies focused on the 4 major urban areas of New Zealand: Auckland, Wellington, Christchurch and Dunedin.

4 The following variable set is obtained from mesh block output (see Appendix II.2). Census district data is provided by the N.Z. Department of Statistics via the aggregation of mesh block data. Although several additional variables are tabulated at the subdivision level (ethnic origin, religion and education are among the main ones) it is evident that there is a sufficient variety of household data available at the census district level to permit a meaningful analysis of Christchurch's social and demographic structure -

and at a scale likely to maintain a higher degree of within-area homogeneity than would be the case with a more highly aggregated data base.

Variable set used in analyses

Variable	Categories Number	Description
Age	7	% 0-4; 0-14; 15-19; 20-24; 25-44; 45-64; Over 65
Dwelling Type	2	% Houses; flats
Sex	1	% Females
Marital Status	3	% Never married adult; married; separated, widowed or divorced
Dependents	2	% Housewives; students
Households	1	% Single Family household
Tenure	6	% Free; Gift; Own; Rent; Table Mortgage; Flat Mortgage
Income (male)	4	% < \$1800; \$1800-\$2999; \$3000-\$5999; > \$6000
Occupation (male)	6	% Professional; Administrative; Clerical; Sales; Service; Labourers.
Race	1	% Non-Maori

5 Multicollinearity is said to be present when two or more variables which are highly intercorrelated have closely matching correlations with the remaining variable set. Careful inspection of the correlation matrix is normally sufficient to detect the presence of such an effect.

6 There have been several articles in the geographical literature in recent years which have attempted to draw attention to problems of interpretation in factor analysis. Examples include the Davies-Mather debates (see Davies, 1972) and the Hunter-Nicholson and Yeates debate (Hunter, 1971b; Yeates, 1971) and the paper by Forster and Stimson (1972).

7 Other geographic studies to undertake oblique rotation other than the direct oblimin method include Timms (1971), Walter and Wirt (1972), Hughes and Carey (1972) and Badcock (1973).

8 For examples of alternative association matrices see Horst (1965) and Johnston (1973c).

CHAPTER THREE

THE STRUCTURE OF CHRISTCHURCH'S HOUSING MARKET AND THE MIXTURE OF POPULATION AND HOUSING CHARACTERISTICS IN URBAN SUBAREAS

This chapter is concerned, in the first instance, with a classification of the existing housing stock of Christchurch. In particular, analysis concentrates on the private ownership sector of the housing market, where an attempt is made to identify the various housing submarkets of the city. Identification of housing submarkets is seen as an important step in modelling locational choice, since residential relocation is normally directed to those areas which contain residences capable of satisfying the dwelling requirements of the mover households.

The second section proceeds to examine one of the complicating factors in housing market analysis and locational choice modelling, namely the problem of areal heterogeneity of housing (and population) characteristics. It is recognised that the predictive efficiency of locational choice models to be formulated and tested later in the thesis will rest heavily on the heterogeneity of the city's residential districts. As such, levels of within-area heterogeneity for population and housing variables must be isolated for inclusion in the appropriate location-allocation models.

THE STRUCTURE OF THE HOUSING MARKET

The housing market may be considered, quite simply, as the total stock of housing within a particular region. Such markets are necessarily confined to a limited geographical area since it is at the local level where almost all the competition exists among households for different dwellings. At the urban area level therefore, a housing market area is normally taken to include housing stock in the central city, surrounding suburbs and the outlying fringe areas. In most capitalist economies the housing market is divided into different sectors: private and public, rental and ownership. In the analysis which follows, attention is centred on the structure and pattern of Christchurch's private ownership housing market. This decision is made in view of one of the principal research objectives of the thesis: to establish models for predicting the outcome of moves by individual households to ownership property.
It is evident that separate models are required for the explanation and prediction of residential movement within the rental market (Speare, 1974; Moore, 1973).

Submarkets Within A Housing Market

Within any housing market area most dwelling units may be considered as being linked to each other to some degree. Overlaps or similarities in family preferences, the relative uniformity of housing plans and the standardisation of building materials form the basis for such linkages. However, the durability of housing, variability in dwelling styles over time, the adaptation of buildings to their particular sites, and variations in the amount and quality of housing which individuals and families are able to consume are factors which serve to diversify an urban area's existing housing supply. In fact, the housing market tends to be compartmentalised into segments characterised by different kinds of housing. These segments are commonly termed housing submarkets.

Following from earlier work by Rapkin, Winnick and Blank (1953) Grisby's (1963) conceptualisation of the nature and operation of housing submarkets remains the most detailed[1]. Grigsby defines a housing submarket in terms of 'substitutability', that is, the degree to which a dwelling or group of dwelling units represents a substitute for another. An alternative approach has advanced that, at least operationally, substitutability can only be measured in terms of the influence of certain housing characteristics on price[2]. Submarkets therefore become groups of housing units for which a similar price is demanded. This procedure has the additional advantage of involving one of the principal factors underlying the distribution of households among residences and locations, namely, the price of property.

A less complicated alternative approach (see Simmons, 1968; Martin, 1969) is to consider submarkets differentiated on the basis of such housing variables as tenure, number of rooms, price, age and so on -

the result being a grouping of similar (though not necessarily substitute) types of dwelling. Problems of heterogeneity exist for housing submarket groupings classified on the basis of a single variable, simply because other potential differentiating factors are not considered. In a more comprehensive multivariate submarket analysis in which individual dwellings (or sub-areas comprising a number of dwellings) are classified on the basis of more than one attribute, the potential for within-submarket variation is much lower. Levels of heterogeneity within multivariate submarkets can be progressively reduced by increasing the number of criteria in the classification (type of structure, neighbourhood quality, number of bedrooms, building material, housing quality, interior design and so forth) until sufficient characteristics are listed to reduce the submarket cluster to a small number of similar dwelling units (or residential sub-areas)[3].

Spatial Characteristics of Housing Submarkets

The housing submarkets considered thus far have been aspatial in character. There has been no necessary spatial contiguity requirement for the set of dwellings which comprise a particular housing submarket. For studies concerned with an explanation and prediction of locational choice, as distinct from residence choice, the location variable assumes an important role in the taxonomy of submarkets. Submarkets of the same type are likely to be found in several areas of the city, but it is unlikely that a majority of prospective mover households would be equally satisfied with all as potential destination areas. There are a number of reasons for this:

1) access remains an important consideration for a large number of urban households - not only with regard to workplace, but also to schools and other nodes with which there is frequent, routinised contact.

2) locational attachments. By virtue of living in an area, households tend to form attachments with that neighbourhood, as well as with the adjoining areas through which they normally travel. It has been argued (see Simmons, 1968), p. 640; Poulsen, 1974) that certain households deliberately select a location nearby the former house in order to maintain spatial familiarity, social contact, institutional links, or access with the former neighbourhood.

3) The status or reputation of an area is an important locational criterion for certain households. Most cities have residential areas with sufficient heterogeneity to permit housing requirements to be met in a variety of locations; but the range of possibilities are reduced if area prestige is introduced as an additional discriminatory variable.

By introducing the location of a dwelling or some areal aggregate (if an ecological analysis) into submarket classification, a sufficient condition exists for spatial uniqueness of the dwelling or submarket.

At the present stage of locational choice analysis, such a large array of potential destinations or destination areas is probably calling for a level of precision in modelling which is unlikely to be achieved. What is required is a somewhat smaller set of submarkets grouped by virtue of their spatial contiguity with areas comprising similar types of housing.

CHRISTCHURCH'S HOUSING SUBMARKETS

In a number of residential location studies[4] a common set of factors in household residential and locational preference have been suggested. These include: accessibility; services and facilities; individual site and dwelling characteristics; and neighbourhood characteristics (both social and physical). The principal indicants of a 'site and dwelling' factor have been given as:

1) Section characteristics: in particular the size of the lot, its shape, slope and position within the residential block. The attribute of 'size' is of particular importance to households at different stages in the family life cycle.
2) House size: the importance of the size of the dwelling lies primarily in its use as a measure of its adequacy in satisfying space requirements of households of various sizes and compositions.
3) Building materials: vary in their durability, and when related to age, can provide an indication of condition. In addition, building materials vary in the amount of maintenance required to retain a state of good repair.

4) Age of housing unit: is significant only as it is related to other characteristics of housing supply, namely, quality, condition, size and so on. Age often provides an indication of style, and the degree of technological obsolescence likely to be associated with a particular structure.

5) Housing quality: is a composite index based mainly on the physical condition of the dwelling, and to some extent its age and building materials. At the neighbourhood level, the quality of housing is an important determinant of an area's residential desirability.

6) Housing value: is a reflection of the sum total of all previous housing characteristics listed, as well as a number of other attributes, some of which prove difficult to measure (see Dean, 1953).

7) Local environment: as the locational context for any dwelling, the social and physical attributes of its neighbourhood may also be ascribed to the dwelling unit. Such features include: amount of landuse mixture, residential density, zoning, traffic volume, etc.

Using these indicants it is possible to index the housing stock. In the following sections, attention is focused on the measurement of these characteristics in Christchurch, and their use in a classification of the city's housing stock.

Description of the Data Base

The Government Valuation Department collects a considerable amount of information on housing and land in connection with its role of providing, for each property in New Zealand, an estimate of the land value and the value of the buildings or other improvements (if any) upon such land. In addition, considerable landuse data is held for each property.

Valuation and landuse data[5] was extracted for 57,000 individual residential properties within the Christchurch Urban Area. Each property was assigned to its appropriate census district (see Figure 2.2); categories were established for each variable[6]; and valuation equalisation was undertaken on property in areas valued at different times[7]. Data on all residential property[8] was then tabulated, creating percentage data for 284 census districts on 65 categories.

The Structure of Christchurch's Housing Market: Submarket Types

The principal axes model was used as the major analytic device for submarket analysis, largely because principal axes analysis facilitates the grouping of interdependent (though not necessarily substitute) housing variables into descriptive categories which can be designated as submarket types.

From an initial set of 65 housing indicators, a group of 25 were retained for the final analyses. Variable reduction was made on the basis of redundancy, multicollinearity and marked curvilinearity among the housing indicators.

The dimensions of Christchurch's housing structure are presented in Table 3.1. Seven varimax-rotated components (eigenvalues > 1.0) accounted for 64 percent of the total variation among the 25 variables:

TABLE 3.1

HOUSING STRUCTURE
CHRISTCHURCH 1971 *

VARIABLE	1.	2.	3.	4.	5.	6.	7.	h^2
% $12000-16999	66							60
% $17000-21999	88							80
% $22000-26999	89							81
% $27099-31999	79							65
% 41-80 PERCHES	54							65
% NO SUBDIVISION	-53		-62					76
% 15-19 SQUARES	72							78
% 30-34 SQUARES	82							72
% < $7000		73						81
% 1-20 PERCHES		80						78
% BUILT PRE 1900		80						70
% POOR CONDITION		72						69
% FAIR CONDITION		74						71
% BRICK MATERIAL		-62		64				93
% OTHER MATERIAL		52			58			65
% >160 PERCHES			88					80
% ZONE 9(RESID.)			-56					56
% NO GARAGE				62				68
% BUILT 1960'S				58				75
% 36-40 PERCHES				-54				51
% BUILT 1920'S				-73				71
% 1-9 SQUARES					84			81
% BUILT 1940'S					80			69
% > $32000						92		87
% GOOD CONDITION							92	88
CUM. % VARIANCE	19	37	45	56	64	69	74	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL

1. MEDIUM AND HIGH VALUE HOUSING
2. LOW QUALITY HOUSING
3. VACANT URBAN
4. DWELLING TYPE
5. STATE HOUSING
6. EXPENSIVE HOUSING
7. GOOD CONDITION HOUSING

1) Medium and High Value Housing

The indicators relating to the capital value of property offer the best guide to the nature of this submarket type. A considerable range in property values is apparent, although very high and very low valued properties do not load highly on this particular housing dimension. The additional housing indicators, section size (41-80 perches) and house size (1500-1900 and 3000-3400 square feet) confirm this dimension as one relating to medium and high value housing.

2) Low Quality Housing

The second component is one clearly related to low quality or low value housing. Variables which index housing quality, such as age, physical condition, and building material are all present on this dimension. Additional variables which serve to reinforce this labelling are small section size and low property value. Although labelled as a low quality housing component, the submarket type is, in fact, one relating to general housing quality - one which will permit the identification of a series of areal submarkets[9] which vary in housing quality. In a similar manner, the first dimension can also be seen to identify a series of areal submarkets which vary in property value.

3) Vacant Urban Land

This is a dimension which is not strongly tied to housing variables. Instead the principal loadings relate to section and neighbourhood characteristics. As a bi-polar dimension, submarkets will range from those where sections are small, have no potential for further subdivision and are in areas not exclusively residential, to those in which all landuse is allocated for residential purposes and where there is considerable scope for subdivision.

4) Dwelling Type

An inspection of high loadings on this component indicates that 'age of dwelling' is the major descriptor for the fourth housing dimension. This dimension indexes at least two aspects of Christchurch's housing market. Firstly, it permits the identification of neighbourhoods developed at different periods; and since building styles and types tend to vary over time, the second feature likely to be reflected in this dimension relates to dwelling type. Here there is range from recently built, suburban single family detached houses (of brick or concrete block construction) through to housing submarkets characterised by a higher residential density due to the mixture of the more recent multi-unit structures (town houses, ownership flats and blocks of flats or apartments) with older style detached dwellings.

5) State Housing, 1940's

With high loadings on small floor area, building material other than weatherboard or brick, and 1940's period of construction, the fifth housing dimension represents a distinctive segment of Christchurch's housing stock, namely State rental housing. For the past 50 years it has been part of Government policy to assist in the provision of housing for New Zealand's population. Under the initial State housing scheme of 1936-37 (a period of acute housing shortage), State housing remained the property of the Government. Since 1950, however, the State Advances Corporation (now the Housing Corporation) has been empowered to sell State housing and land. State housing built during the 1940's was distinctive in other respects besides being purpose built for rental. Firth (1949, p. 70) lists some of the features: typical floor areas for houses were 650 sq. ft. (one-bedroomed house), 880 sq. ft. (two bedrooms), 1055 sq. ft. (three bedrooms) and the most common building materials were weatherboard (40 percent of houses) followed by asbestos sheet (35 percent) and brick (25 percent).

Due in large part to an absence of large concentration of State housing in Christchurch[10] and a gradual increase in variety of design, size, structure and building materials, State housing built since 1950 is more closely aligned (at least in terms of the present set of housing indicators) to the surrounding private stock. As a consequence, additional State housing dimensions are not forthcoming.

The remaining two dimensions do not contribute significantly to a description of Christchurch's housing stock over and above the single variables which load highly on the components concerned. Areas with good condition housing and expensive housing should be readily identifiable from the two principal dimensions described earlier.

As with the social and demographic dimensions in the previous chapter, the housing structure loadings matrix was subjected to oblique rotation. The factor pattern and inter-factor correlations presented in Table 3.2 suggest that the original orthogenal structure is quite stable,

TABLE 3.2

OBLIMIN ROTATION OF COMPONENT
ANALYSES : HOUSING STRUCTURE

A. COMPONENT PATTERN

VARIABLE	1.	2.	3.	4.	5.	6.	7.
% < $7000	-30	52	-04	-26	30	16	-09
% $12000-17000	65	-22	02	05	-15	-12	-02
% $18000-22000	91	-05	-02	14	-01	04	03
% $23000-27000	92	02	03	08	07	07	01
% $28000-32000	82	16	-05	-03	-05	03	-03
% > $32000	11	-13	12	-11	-07	94	-02
% 1-20 PERCHES	03	65	-19	05	09	29	-21
% 36-40 PERCHES	10	12	31	-52	03	-22	-02
% 41-80 PERCHES	46	-17	26	-33	14	-21	08
% > 160 PERCHES	06	06	87	11	08	08	10
% ZONE 9(RESID.)	19	03	-70	03	15	01	26
% NOGARAGE	-10	41	-05	64	16	02	-17
% NO SUBDIVISION	-51	-05	-57	00	-22	-05	-23
% BUILT PRE 1900	16	87	-03	00	-07	-09	05
% BUILT 1920'S	-02	06	-16	-77	05	24	-02
% BUILT 1940'S	-01	-38	-05	-11	62	-07	02
% BUILT 1960'S	01	-24	11	57	-41	-05	08
% POORCONDITION	-14	75	32	-06	02	05	16
% FAIR CONDITION	01	63	-12	-17	06	-14	-35
% GOOD CONDITION	-09	13	-11	-05	-05	-04	97
% BRICK MATERIAL	01	-39	10	64	-33	-07	11
% OTHER MATERIAL	-01	27	07	-09	62	07	-13
% 1-9 SQUARES	-18	27	04	29	71	02	-07
% 15-19 SQUARES	64	08	-03	-42	-21	-05	-12
% 30-34 SQUARES	82	07	-09	-14	-01	04	-02

B. COMPONENT STRUCTURE

VARIABLE	1.	2.	3.	4.	5.	6.	7.
% < $7000	-37	71	-11	-30	55	30	-33
% $12000-17000	69	-35	11	-07	-32	-22	18
% $18000-22000	88	-17	08	-07	-18	-06	20
% $23000-27000	89	-06	13	-16	-08	-01	16
% $28000-32000	78	08	03	-23	-12	-02	07
% > $32000	08	00	04	-11	-01	89	-05
% 1-20 PERCHES	-15	77	-25	-05	29	44	-41
% 36-40 PERCHES	26	15	35	-57	11	-25	-02
% 41-80 PERCHES	60	-20	36	-45	05	-31	22
% > 160 PERCHES	12	03	87	05	06	-02	18
% ZONE 9(RESID.)	12	09	-66	00	11	06	20
% NOGARAGE	-36	43	-12	58	20	13	-26
% NO SUBDIVISION	-57	00	-64	17	-14	05	-34
% BUILT PRE 1900	09	81	-02	-12	11	02	-12
% BUILT 1920'S	11	21	-16	-77	21	27	-13
% BUILT 1940'S	-07	-17	-04	-20	73	-05	03
% BUILT 1960'S	-02	-44	11	66	-58	-14	23
% POORCONDITION	-15	74	29	-11	23	13	-04
% FAIR CONDITION	-08	72	-15	-28	26	00	-50
% GOOD CONDITION	08	-10	-02	03	-08	-10	92
% BRICK MATERIAL	-02	-58	12	74	-55	-18	30
% OTHER MATERIAL	-14	48	04	-22	73	18	-26
% 1-9 SQUARES	-39	46	-01	18	77	15	-21
% 15-19 SQUARES	75	03	05	-56	-22	-11	-04
% 30-34 SQUARES	83	01	00	-34	-09	-02	08

C. COMPONENT CORRELATIONS

1.	100						
2.	-11	100					
3.	11	-02	100				
4.	-25	-12	-03	100			
5.	-15	26	-01	-16	100		
6.	-09	15	-11	01	09	100	
7.	17	-24	10	07	-09	-10	100

COMPONENT LABEL

1. MEDIUM TO HIGH VALUE HOUSING
2. LOW QUALITY HOUSING
3. VACANT URBAN
4. TOWN HOUSES - OWNERSHIP FLATS
5. STATE HOUSING
6. EXPENSIVE HOUSING
7. GOOD CONDITION HOUSING

and the components possess sufficient identity to be considered as separate, though not altogether unrelated housing dimensions.

Spatial Patterns of the Housing Submarkets

Areas of high property value occupy distinct spatial locations within Christchurch (see Figure 3.1). The sector to the northwest of the city centre contains the largest proportion of medium and high value property, although more recently there has been an increase in high quality housing on the north-facing slopes of the Port Hills, see Johnston (1969). Elsewhere there is little areal variation in property value, most of the residential areas having a majority of their properties in the low to medium value categories.

The variation in housing quality across Christchurch's residential areas (Figure 3.2) mirrors, to a large extent, the growth pattern of the city (see Figure I.3). In most housing quality studies, the age of housing is one of the principal factors involved in indexing the depreciation of a dwelling, and it would appear as though the period of construction is being strongly reflected in the pattern of housing quality. With the exception of Belfast and New Brighton, two areas which resulted from 'leapfrog' settlement, all poor quality housing is concentrated in the central area of the city. In fact, there is almost perfect correspondence between this inner zone and the area chosen by Pownall (1960) for his study of low value housing. In 1960, almost 14 percent of houses in this central area were depreciated by 80 percent or more of

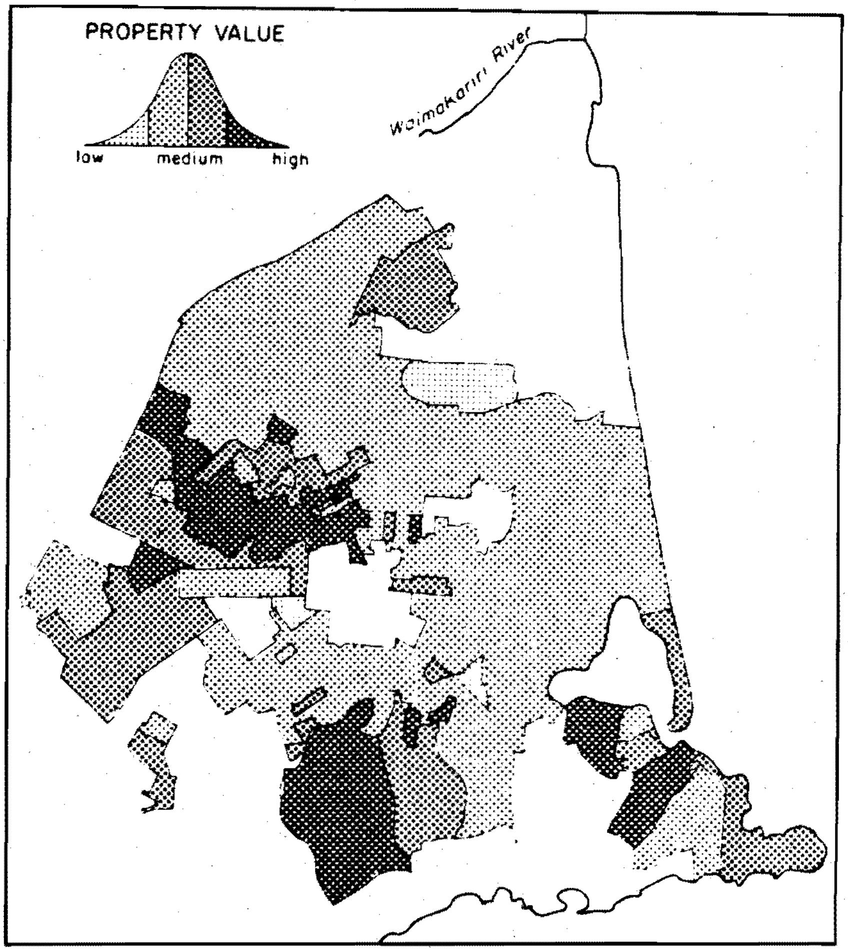


FIGURE 3.1 : CHRISTCHURCH : PROPERTY VALUE

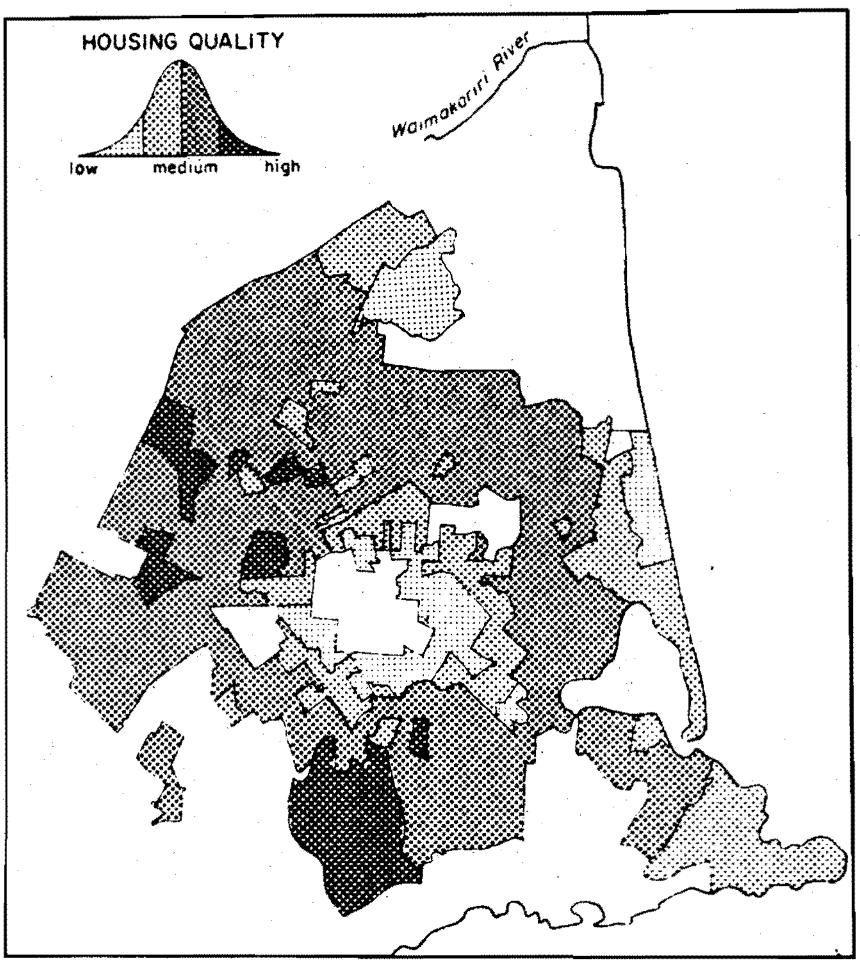


FIGURE 3.2 : CHRISTCHURCH : HOUSING QUALITY

their replacement cost. An additional 33 percent of the houses in this inner zone were in the 70 to 80 percent depreciation category. Such figures are to be expected when it is considered that most of these houses are of weatherboard construction, a building material whose average life ranges between 60 and 80 years. As a consequence, housing built prior to or just after 1900 is approaching the stage for replacement. To the south and southwest of the centre of the city this has meant a gradual conversion to industrial landuse, while to the north and east higher density residential redevelopment is underway.

The spatial impact of higher density development is reflected in Figure 3.3, where it can be seen that there are five or six districts in the city which have become the focus for multi-unit construction. An initial concentration of ownership flat and town house development in the higher status areas such as Merivale, Papanui and parts of Ilam and Fendalton, is now giving way to a much wider areal base which includes the suburbs of Bishopdale, Riccarton, St Albans, Beckenham, St Martins, Opawa and Linwood[11]. While adjacent areas exhibit mixture of dwelling types to a lesser extent, the outer suburbs remain the almost exclusive preserve of the single family detached dwelling.

It is also in the outer suburban areas and the hill suburbs that much of Christchurch's vacant urban land is located (see Figure 3.4). Vacant land is considered here to derive from two sources: land which remains to be sub-divided and sections which themselves could be further divided. From this information, a clear indication is

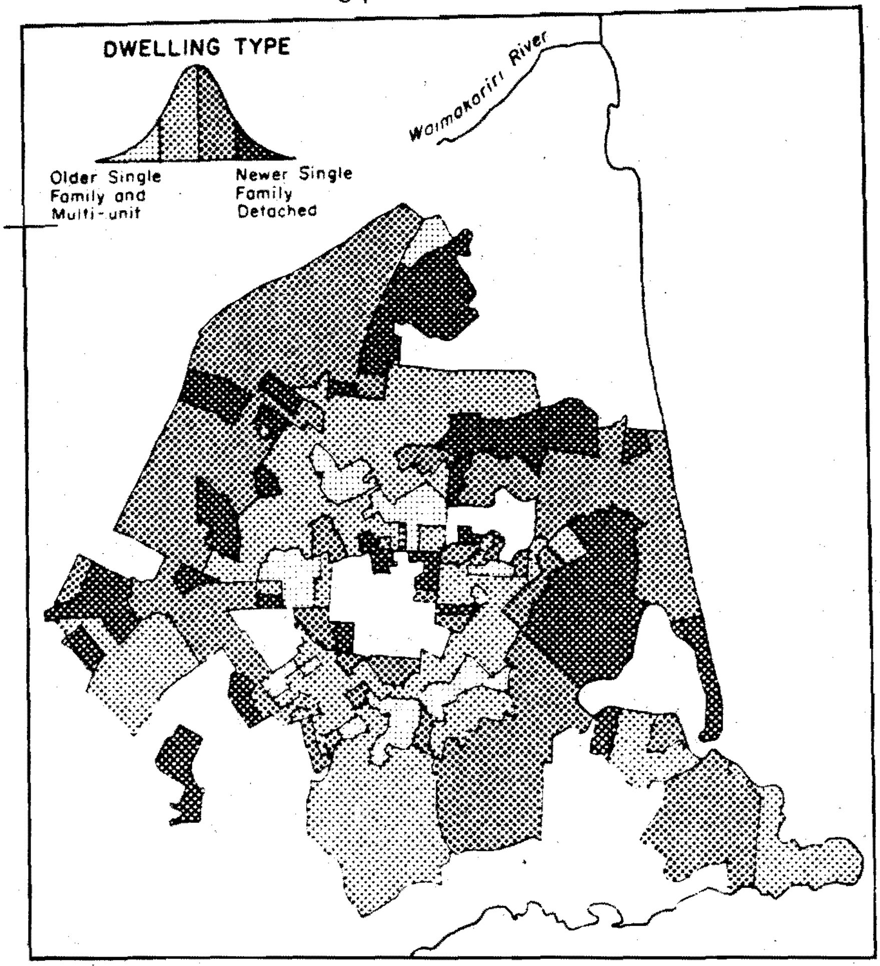


FIGURE 3.3 : CHRISTCHURCH : DWELLING TYPE

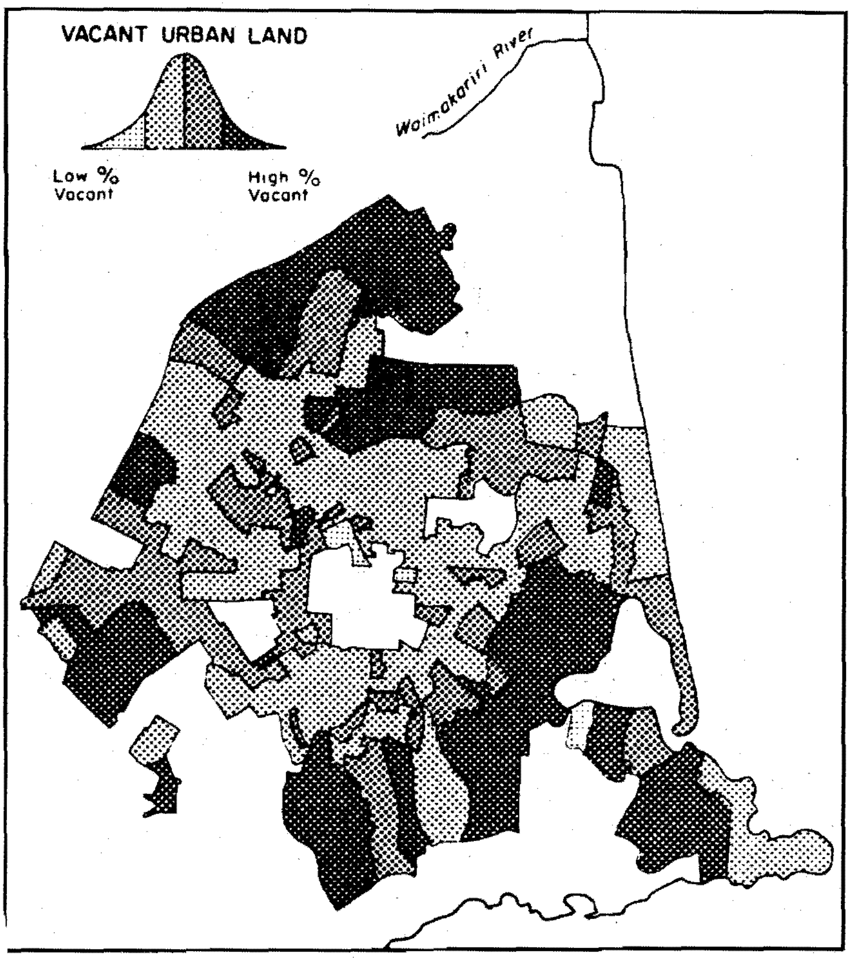


FIGURE 3.4 : CHRISTCHURCH : VACANT URBAN LAND

afforded of those areas in which the bulk of new residential construction is likely to be concentrated over the next 10 to 15 years.

The final housing dimension to be mapped locates the principal areas of housing established during the 1940's. It is likely that the majority of such construction was for State rental purposes. Apart from a concentration at New Brighton, most of the housing is scattered throughout the city, occupying what would have been, at the time of construction, peripheral locations (Figure 3.5).

While the remaining two housing dimensions each have one high loading, suggesting labels of 'expensive housing' and 'good condition housing', it would be misleading to classify areas on the basis of such labels. The reason for this rests with the fact that a component score for an observation on a particular component reflects all loadings on the component in question (see Horn, 1973; Tarrant, 1974). In the present situation, therefore, should a classification of areas of good quality, expensive (or conversely, poor quality, inexpensive) housing be required, recourse to the original variables is to be preferred.

THE HOMOGENEITY OF CHRISTCHURCH'S RESIDENTIAL SUBAREAS

Having identified the major dimensions of housing structure in Christchurch, and commented on their spatial configuration, attention is now directed to an investigation of the variation that exists within, rather than between, the residential subareas of the city.

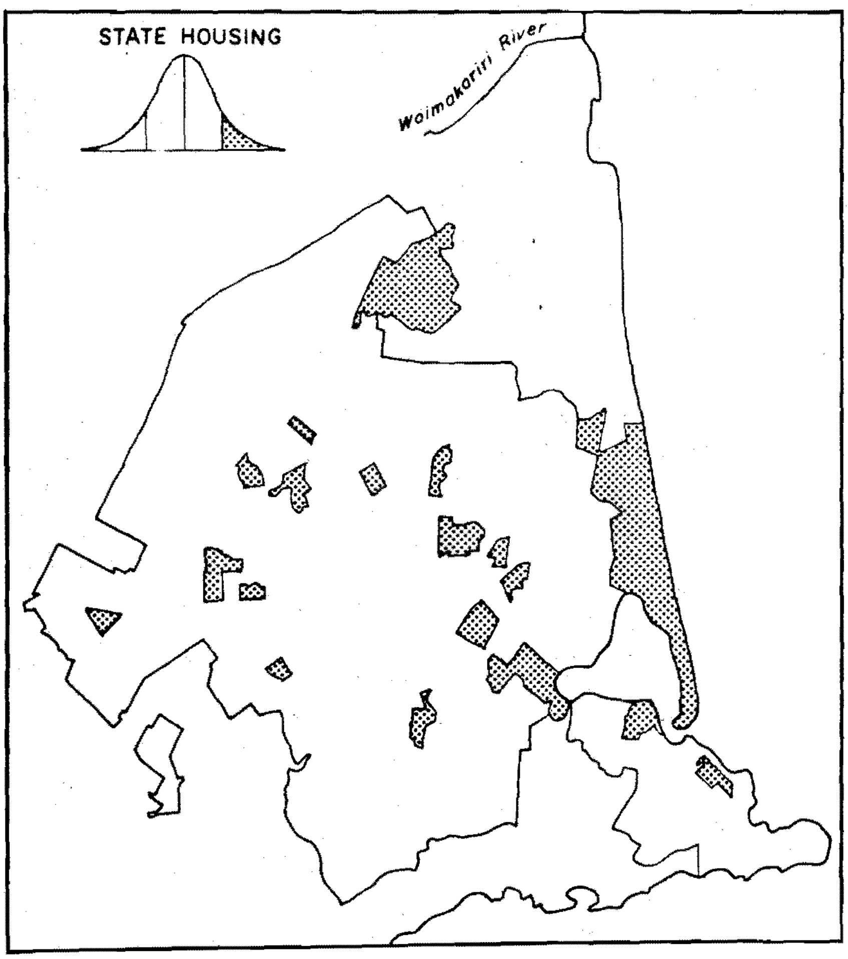


FIGURE 3.5 : CHRISTCHURCH : STATE RENTAL HOUSING - 1940s

THE HOMOGENEITY ASSUMPTION IN URBAN AREA STUDIES

The social area and the housing submarket are both basic concepts in urban theory. Although the former is largely concerned with population attributes while the latter is exclusively concerned with dwelling-related characteristics, both share a common theoretical assumption which relates to the homogeneity of their constituent 'populations'.

The aim of the present section is, firstly, to consider the homogeneity assumption in a wider context by briefly examining its role in the theory of increasing societal scale, factorial ecology and, most importantly, household locational choice studies. Secondly, an attempt is made to examine the degree of homogeneity within the census districts of the Christchurch urban area as well as the spatial patterning of within-area variation throughout the residential areas of the city for a set of population and housing variables.

Homogeneity and the Theory of Increasing Societal Scale

The theory of increasing societal scale, which provides the theoretical underpinnings of social area analysis, proposes that as the social and economic organization of society becomes increasingly complex, so too will its spatial organization, with a resultant areal segregation of functionally differentiated units. As a result, particular social areas should become more homogenous in their functional composition, but more distinct from other social areas (see Udry and Butler, 1968).

Homogeneity and Factorial Ecology

Proponents of social area analysis tend to view the differentiation of the residential areas of the city from a macro-level or societal standpoint. In comparison, the more recent factorial ecologies either implicitly or explicitly ascribe to the hypothesis which suggests that different groups within an urban society, through their preferences and their differential access to the housing market, choose, or are forced to occupy separate residential areas (Rees, 1970; Johnston, 1974a). Should such a set of conditions in fact hold, and assuming that the boundaries of observation units conform to the boundaries of these areas, then we may expect relatively homogenous districts.

At least three factors work against such a situation. Firstly, it is uncommon at present for administrative boundaries to coincide with social worlds, local environments or activity spaces. Secondly, in commenting upon residential patterns in New Zealand cities, Johnston (1974b, p. 165) draws attention to a general absence of marked differences in wealth between residential districts (due to a narrow range of incomes and relatively high taxation rates). This is not meant to suggest an absence of any spatial separation of various household groups, but rather is an indication of somewhat more mixed residential subareas than one finds in the larger Australian and North American cities. Finally, the city is not a static system. Neighbourhoods undergo change and in some cases this change involves a shift in the composition of the population and a variation in the type and quality of the housing stock.

The five-stage model of areal differentiation proposed by Hoover and Vernon (1962) in which residential areas may be seen to pass through building-up, transition, downgrading, thinning-out and renewal stages indicates the types of changes in the composition of neighbourhoods which can be expected through time.

Since it is unlikely that all residential subareas of a city will contain relatively homogenous populations, the validity of classifications, or more particularly areal comparisons based upon them is questionable. Myers (1954, p.364) explains this as follows:

> *... if the unit employed does not possess a relatively high degree of homogeneity (on the variables under study, then) the derived data may be unrepresentative of that particular unit as well as basically incomparable with data from other more homogenous units.*

It would seem advisable, therefore, in an effort to gain a more complete picture of the population and housing patterns within cities, that internal variation within the observation units is studied in addition to the more usual between-unit variation.

Homogeneity and Household Locational Choice Studies

Despite a number of recent elaborate conceptualisations of the residential relocation process (Butler et. al., 1969; Brown and Moore, 1970; Prior, 1974), all changes of residence can be seen, in their simplest form, to involve a matching of a household's demand for a dwelling and location with the supply of available housing located at various points throughout the city. In other words, mover households can be allocated, on the basis of their demand requirements to certain locations within a city which contain dwellings of the type sought by the mover household.

As the models to be developed in the present thesis are concerned with predicting the locational outcome of an intra-urban residence-shift (i.e. a mover household is to be allocated to housing within some pre-defined spatial unit - a census district or group of census districts), the mixture of housing characteristics within residential subareas of the city assume an important role in determining the number of successful allocations or predictions which are likely to be made. Consider a simplified example of 4 mover households whose sole demand requirement relates to the cost of property. The upper price limits for the households are as follows:

Household A : \$12,000   Household B : \$17,500
Household C : \$25,000   Household D : \$32,000

An areal unit (census district or otherwise) with a profile of property prices as illustrated in Figure 3.6 could be the potential destination for <u>all</u> four mover households. If all census districts in the city possessed a similar variety in property values (i.e. relatively heterogenous with respect to price) then a successful allocation of mover households to particular locations is unlikely to eventuate.

That a mover household normally has several dwelling and locational requirements to be met in the process of relocation means that potential destination areas require stratification by a variable set analogous with the demand criteria of the mover household. The introduction of

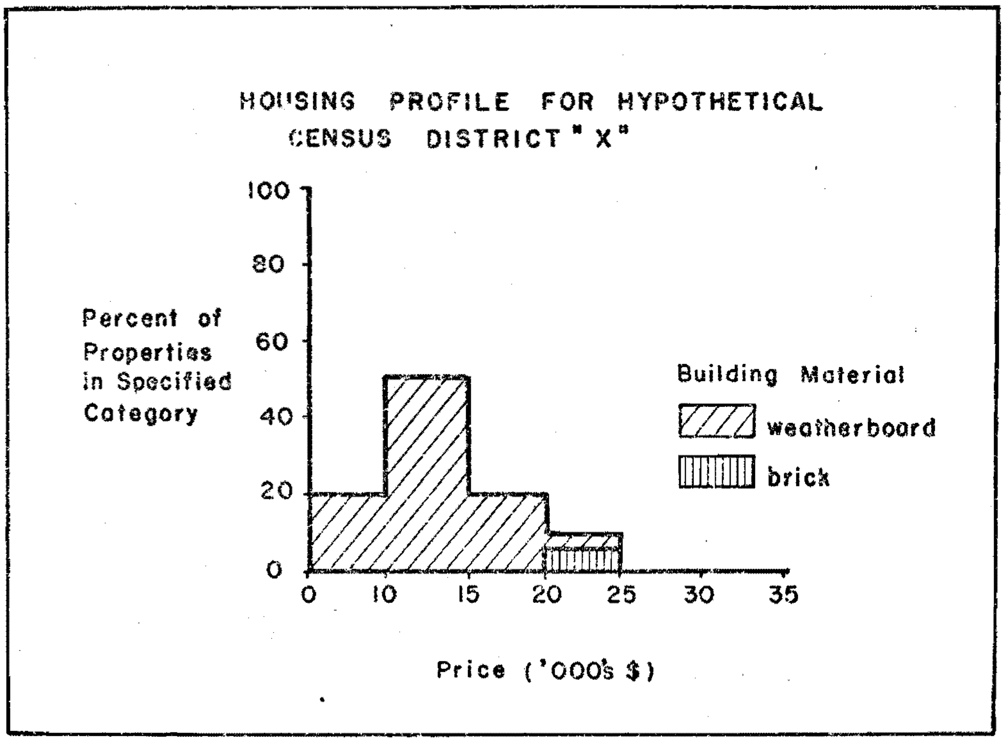


FIGURE 3.6 : HOUSING PROFILE FOR
HYPOTHETICAL CENSUS DISTRICT 'X'

additional variables into an areal classification can be seen to narrow the range of possibilities for satisfying certain combinations of demand requirements. By stratifying properties in census district 'X' by 'building material' as well as 'price', it is now apparent that any of the mover households requiring a dwelling of brick construction in area 'X' will be forced to pay between $20,000 and $25,000 - a price range unsuitable for households A and B. To summarise:

1) it is important that the homogeneity of Christchurch's census districts be determined for a range of population and housing variables. It is clear that widespread heterogeneity of the residential subareas of a city reduce the likelihood of a high proportion of correct allocations of mover households to new residential environments.

2) a multivariate classification of residential subareas means that, at least for certain combinations of dwelling and locational variables, there will be a limited number of areas which can satisfy a particular mover household's demand requirements.

Nonetheless, the greater the heterogeneity of subareas, the greater is the opportunity for the substitutability of subareas as potential destination areas for an intra-urban move.

THE MEASUREMENT OF WITHIN-AREA VARIATION

The Index of Qualitative Variation

Since the existence of a number of nominal variables in both census data and Valuations data prevents application of the usual measures of variability, the measure used to assess the degree of within-area variation in

Christchurch's residential subareas is the Index of Qualitative Variation (IQV)[12]. This statistic is designed to measure the dispersion into different categories of a variable whose categories need not be ordered.

The relative amount of variation is determined by the ratio between the observed number of differences among the categories of a given variable and the hypothetical maximum:

$$IQV = \frac{\text{Total Observed Differences}}{\text{Maximum Possible Differences}}$$

$$= \frac{\sum n_i \, n_j}{\frac{k(k-1)}{2}\left(\frac{N}{k}\right)^2} \qquad \left[\, i < j \,\right]$$

where n_i = number in ith category

n_j = number in jth category

k = number of categories

N = total frequency

This index will always vary between zero and unity. If the numerator is zero, the index will likewise be zero and will reflect the complete absence of variation. In the event of an equal division of observed frequencies of attributes, the numerator and denominator will be identical, and the index will be unity, reflecting maximum heterogeneity or variation. Intermediate degrees of heterogeneity will take on intermediate index values.

<u>Sensitivity of IQV</u>

Before presenting the results of the homogeneity analyses, some comment is required on the sensitivity of the index under two conditions:

1) when there is a change in the number of categories, and
2) when there is a change in the distribution of values among categories.

Several computations using hypothetical data would appear sufficient to establish that IQV is affected by the number of categories (see Appendix III, 2A). Such a finding is in line with Ferguson and Forer's (1973) examination of four concentration indices. When values are redistributed among categories (see Appendix III, 2B), it becomes apparent that the index is quite sensitive to even slight changes in cell frequencies (compare examples: g, h, i, k). It is also apparent that even the presence of small frequencies in some of the categories is sufficient to generate an index value which seems to overemphasise heterogeneity (see examples: f and m). It appears therefore, that the value of the IQV is sensitive to changes in both the number of categories and the number of observations in the population. For present purposes, the latter constraint was the more important, since it would have interfered with inter-area comparisons. To avoid this, all of the data sets were converted into percentages (of the relevant area totals), thereby producing comparable data metrics.

PATTERNS OF WITHIN-AREA VARIATION IN CHRISTCHURCH, 1971

Measures of within-area homogeneity for 284 census districts (again, refer to Note 8) were calculated for the following variables: occupation status (male), income (male), marital status, and age of residents; value of property, housing quality, building material, age of dwelling, size of dwelling and size of section; and the mode of journey-to-work by resident workers.

The distribution of homogeneity scores for all census districts on the eleven variables is displayed in Figure 3.7. The histograms indicate considerable variation of population and housing characteristics within Christchurch's residential areas. In particular, there appears to be a greater mixture of population types than housing types indicating that, at least up until 1971, a large number of Christchurch's residential districts were 'accessible' to a variety of households. The heterogeneity of some census districts is also a reflection of the change which is taking place in these areas as a function of city growth.

When the IQV values are mapped for each variable, a number of interesting patterns emerge (see Figures 3.8 and 3.9). The age of residents, for example, exhibits a distinctive concentric pattern. In general, the central city areas have the greatest mixture of age groups, while the adjacent suburban areas display a transition toward greater homogeneity - a characteristic of the outer suburbs. A similar pattern obtains for the variable, marital status. In effect, the homogeneity - heterogeneity patterns of age and marital status are a reflection of the distribution of housing type and tenure within the city.

The pattern of within-area variation in occupation to a large extent mirrors that of between-area variation in social status (see Figure 3.10). The difference is that the high social status areas of the city are those which exhibit the greatest degree of heterogeneity in terms of the occupation of the male residents. The low status areas are the most homogenous. It would appear, therefore, that the high status areas of Christchurch are not as 'exclusive' as the low status areas - in terms of occupation at least.

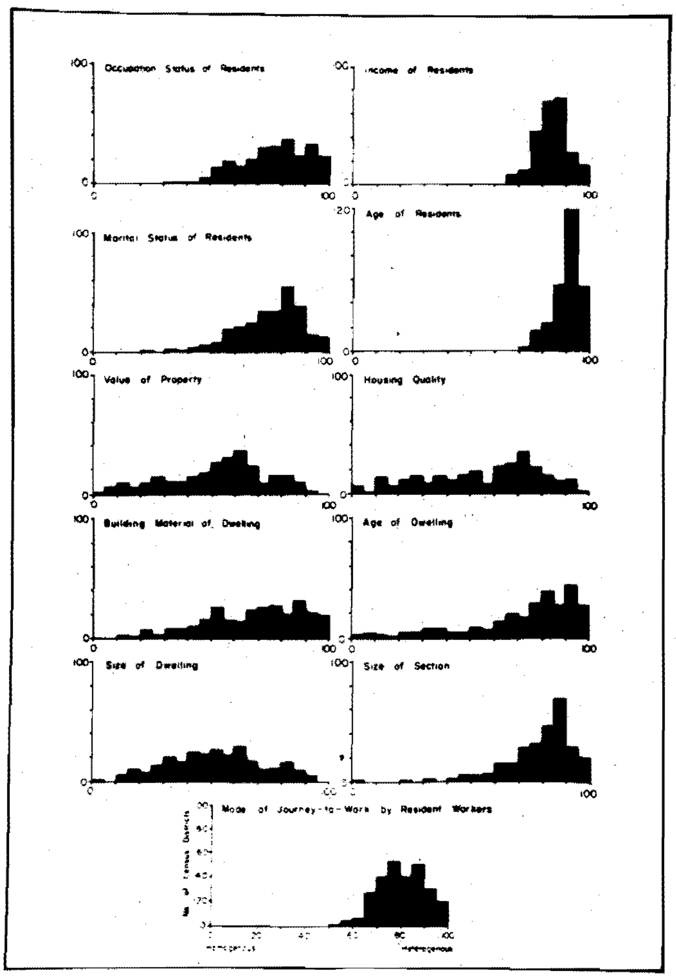


FIGURE 3.7 : DISTRIBUTION OF HOMOGENEITY SCORES FOR CHRISTCHURCH CENSUS DISTRICTS

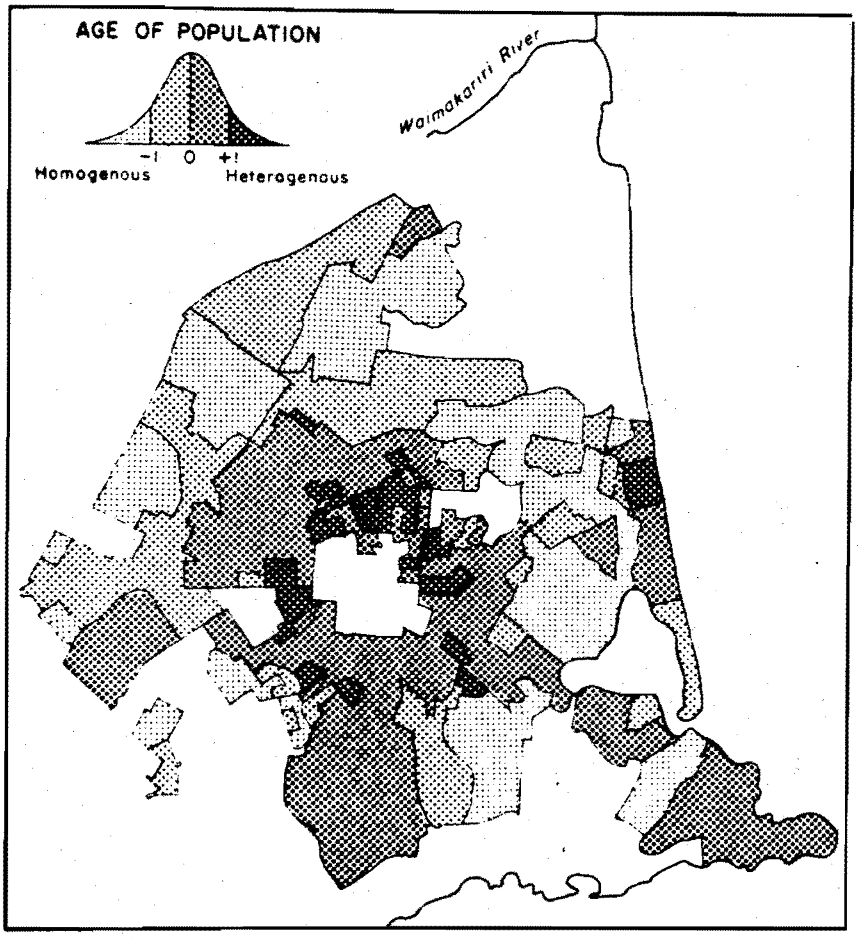


FIGURE 3.8 : WITHIN-AREA HOMOGENEITY :
AGE OF RESIDENTS

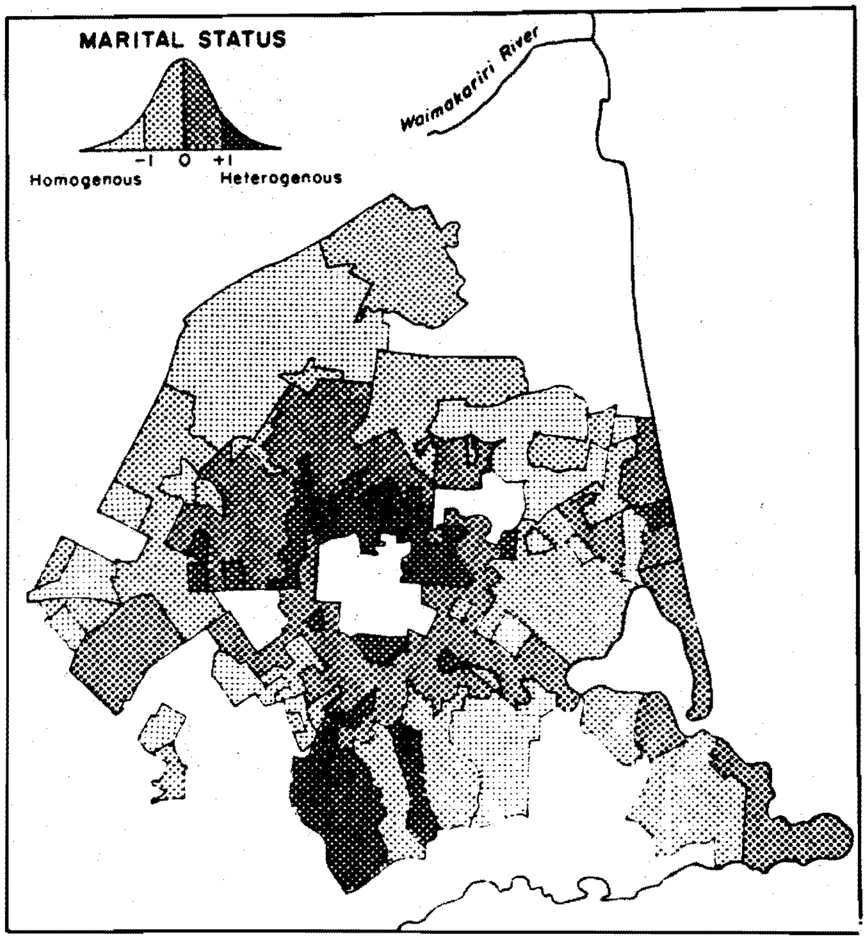


FIGURE 3.9 : WITHIN-AREA HOMOGENEITY :
MARITAL STATUS OF RESIDENTS

A similar pattern tends to hold for income as well (see Figure 3.11). The principal difference lies in the outer areas of the high status northwest sector where there is considerable homogeneity of income - a reflection of the narrow wage band which spans many of New Zealand's occupations.

Having considered only two indicants of family status and two of socio-economic status, a generalisation at this stage may be considered unwarranted. But there does appear to be sufficient evidence to suggest that the most homogenous areas are those of high family status or low socio-economic status; conversely, the most heterogenous areas are those with low family status or high socio-economic status.

The final population characteristic considered is the mode of journey-to-work (see Figure 3.12). There are four aspects to the patterning of within-area variation in this variable:

1) there is a general decline in the mixture of journey-to-work modes with increasing distance from the centre of the city. At least two modes, namely walk and cycle, tend to decline in popularity with increasing separation of residence and workplace.

2) there is a greater heterogeneity in areas which contain, or are immediately adjacent to, sources of employment. Obvious examples are the central commercial area, the suburban centres at Papanui, Riccarton and New Brighton, and the major industrial zones which extend to the west and sout-east of the centre.

3) the role of the major arterial roads in increasing heterogeneity (of journey-to-work modes) in adjacent or bisected areas is also apparent (for example: the major routes west, south-east and northeast of the city centre).

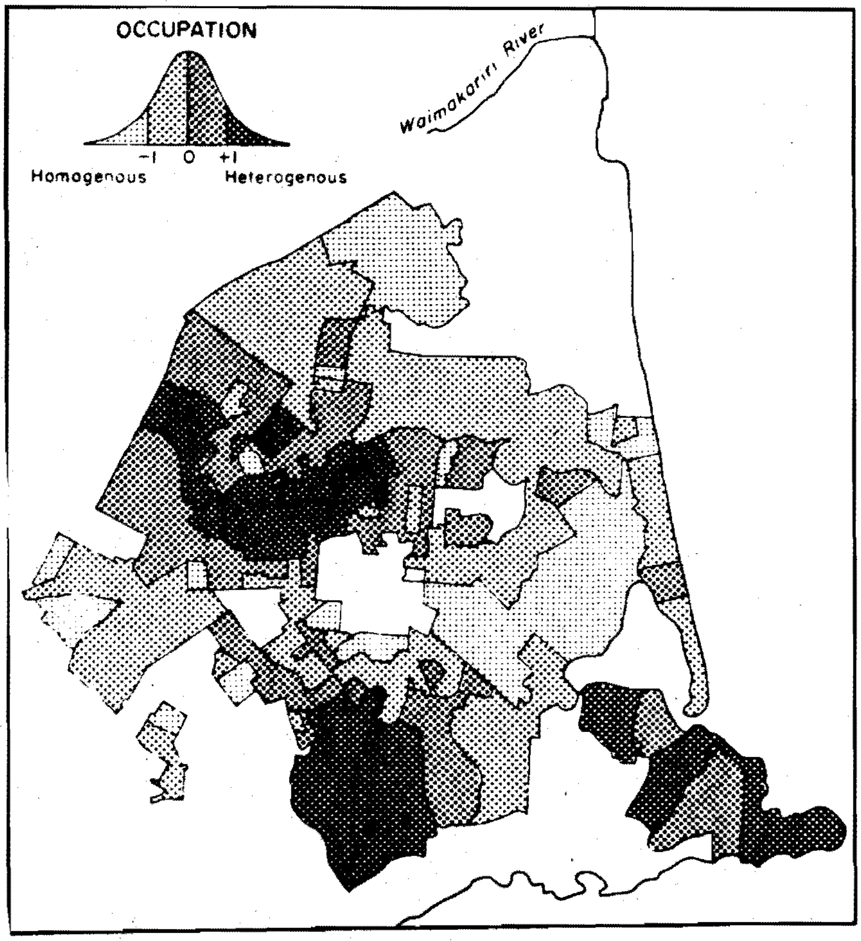


FIGURE 3.10 : WITHIN-AREA HOMOGENEITY : OCCUPATION

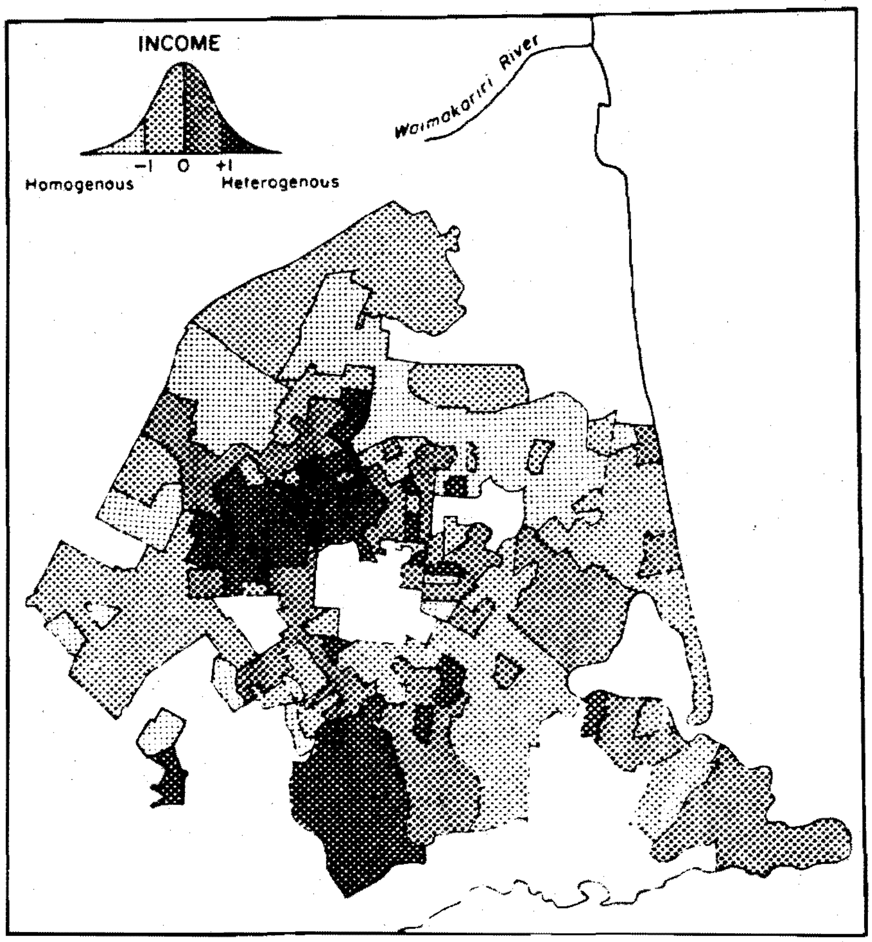


FIGURE 3.11 : WITHIN-AREA HOMOGENEITY : INCOME

4) high status areas, even those close to the centre of the city, exhibit a high level of homogeneity, a reflection of the dominance of private car trips to and from work.

The pattern of within-area variation in property value (Figure 3.13) is in most respects similar to within-area variation in income, with the high status areas being the most mixed in terms of the price of property, suggesting that there are varying degrees of residential status within 'high status' subareas (see Parkes and Newton, 1972). Variation of house size within Christchurch's residential districts, in turn, provides a similar spatial patterning as the two previously-mentioned variables (Figure 3.14).

Of the remaining four housing variables, age of housing and lot size have a spatial patterning with certain common aspects (Figures 3.15, 3.16). These variables, perhaps more than the others indicate those subareas undergoing transition and those areas yet to experience invasion by alternative landuses or housing types. The outer suburbs which stretch in an arc from the west to the north of the city contain dwellings built mainly over the last ten to fifteen years. The recent nature of such residential growth accounts for the similarity in the age of housing. In addition, most of this newer housing has been a result of subdivision development - an end product of which is uniformity in section sizes. Closer to the centre an increase in heterogeneity in lot size is in large part due to subdivision of sections in response to growth in multi-unit development (Nahkies, 1974). Areas exhibiting greatest heterogeneity in dwelling age are those where replacement of existing (and mostly poor quality) structures is being undertaken. The districts with a slightly more homogenous

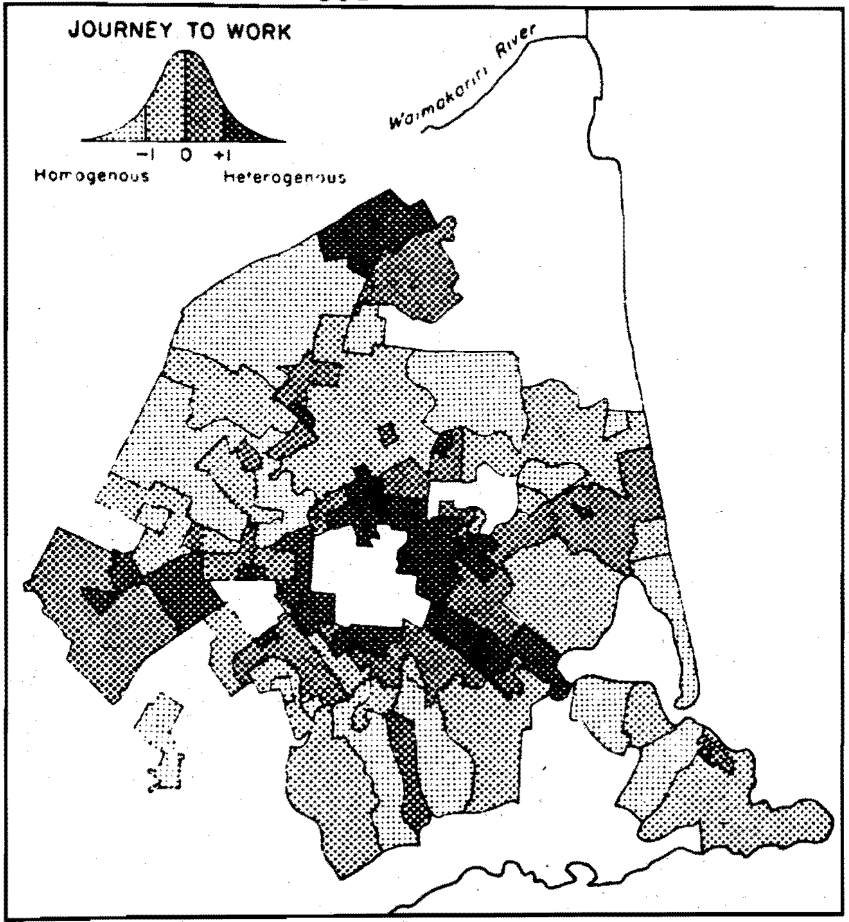


FIGURE 3.12 : WITHIN-AREA HOMOGENEITY :
JOURNEY TO WORK MODE

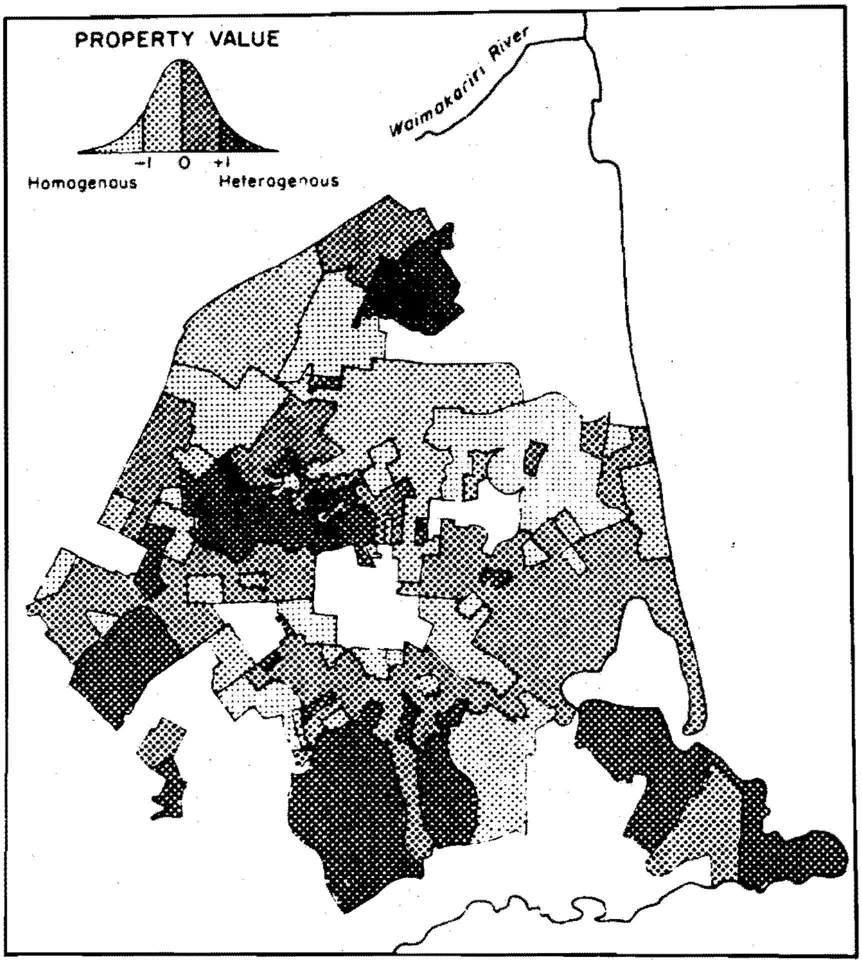


FIGURE 3.13 : WITHIN-AREA HOMOGENEITY :
PROPERTY VALUE

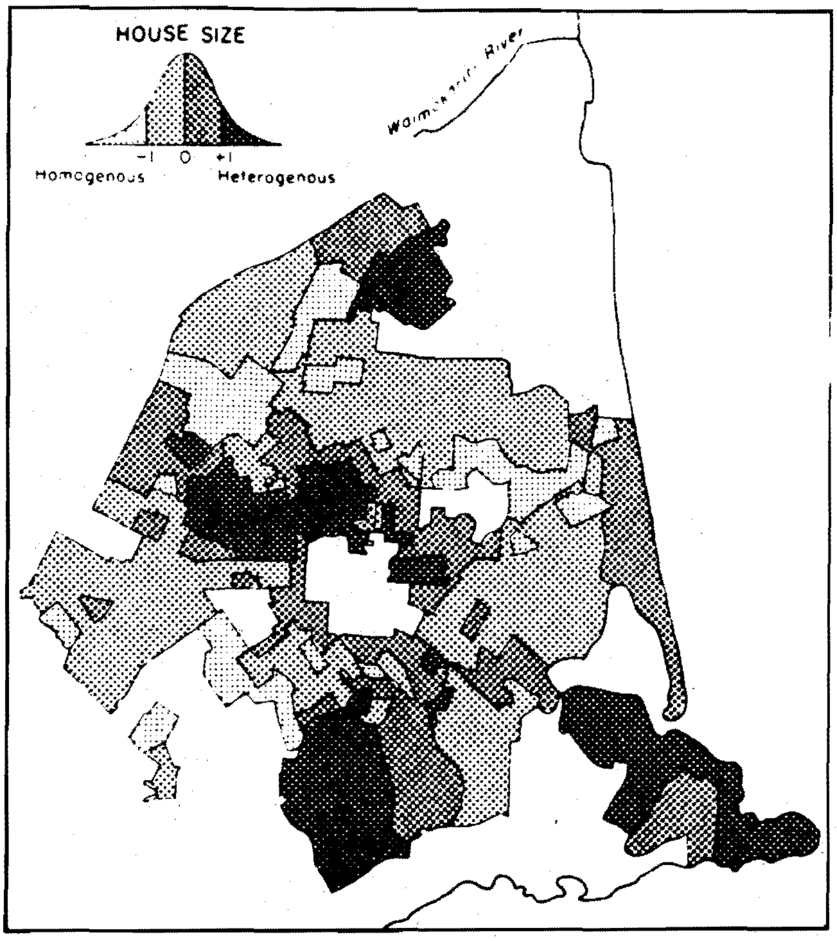


FIGURE 3.14 : WITHIN-AREA HOMOGENEITY : HOUSE SIZE

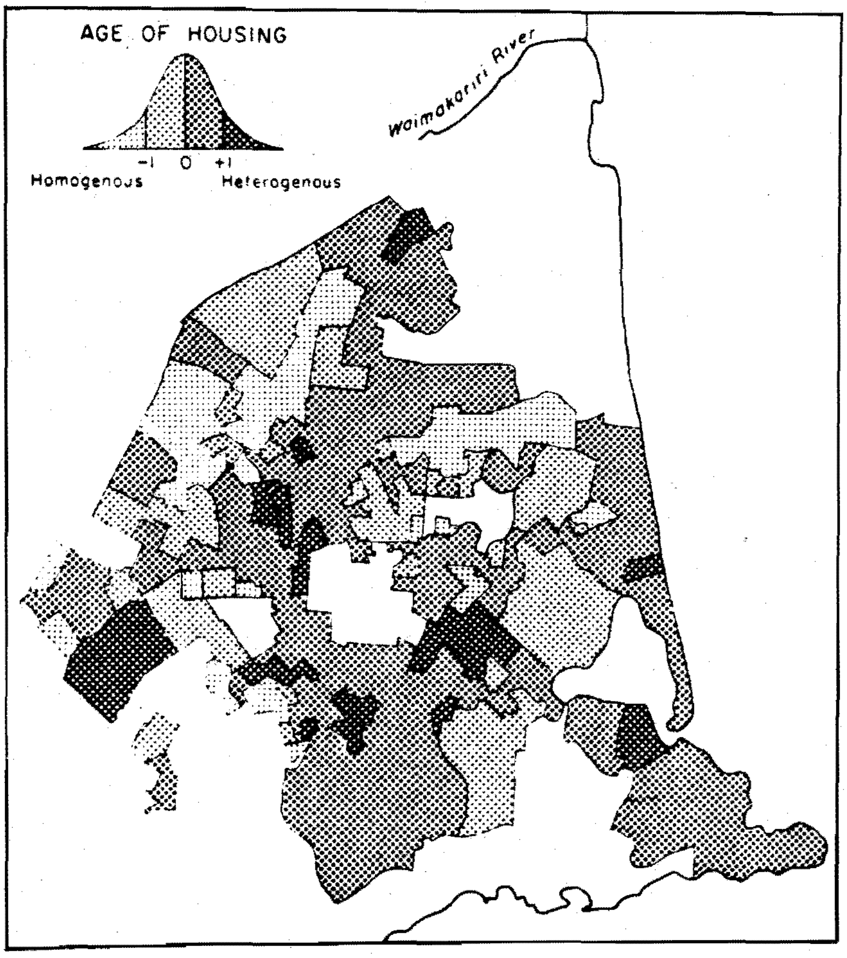


FIGURE 3.15 : WITHIN-AREA HOMOGENEITY : AGE OF HOUSING

stock are those which have experienced, and still are experiencing infilling - a process which involves the occupance of individual sections left vacant after the initial subdivision of an area.

The spatial configuration of the final housing variables, building materials and condition of housing, bear no marked relationship to any of the variables previously considered (see Figures 3.17, 3.18). There is no city-suburban, or high status - low status division. Instead there are several large pockets of distinctive housing mixture. In terms of building material there are two principal zones of homogenous stock - central city and outer northwest suburbs: the northwest suburbs contain housing constructed predominantly of brick or concrete block, while the central city buildings are mostly weatherboard.

In the process of inspecting mapped patterns of within-area variation for the eleven population and housing variables, it is apparent that the homogeneity values for each variable do not portray unique spatial configurations. To obtain a more precise indication of the degree of overlap among the variables, product-moment correlations were calculated on the homogeneity indices for each pair of variables. The first feature to note in Table 3.3 is a predominance of positive correlations, which suggests that an area which possesses homogeneity on one variable will tend to exhibit a certain degree of homogeneity (rather than heterogeneity) on all others. The table of coefficients also suggests a number of clusters of interdependent variables, a fact which encouraged progression one stage further to the

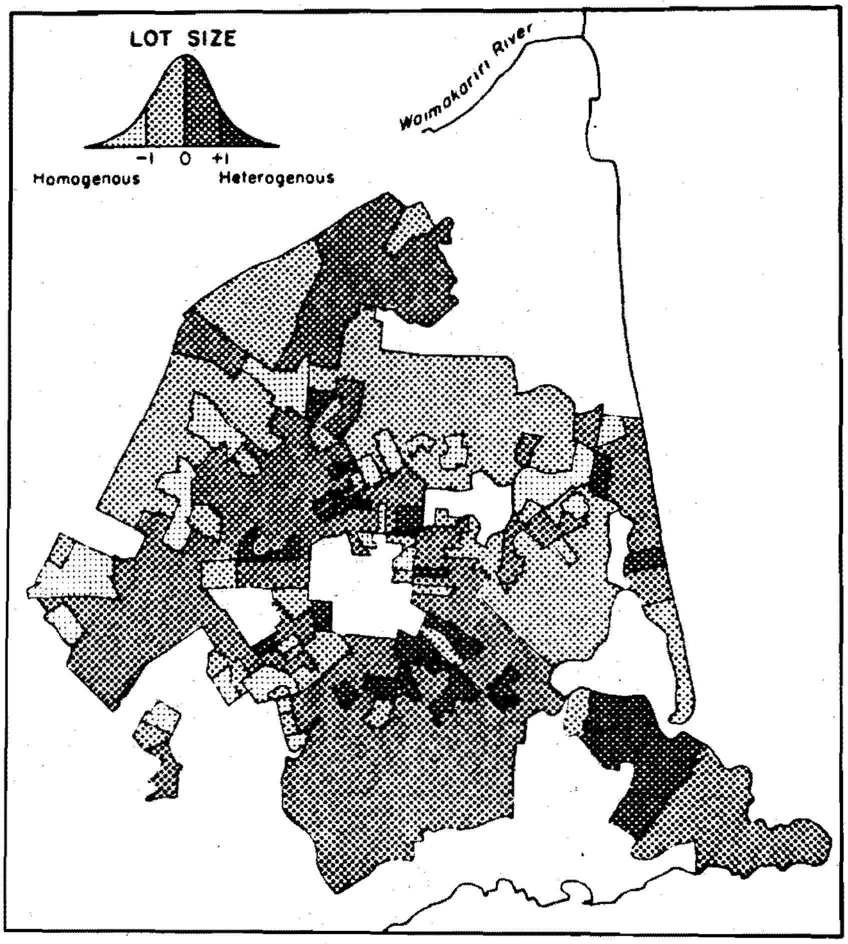


FIGURE 3.16 : WITHIN-AREA HOMOGENEITY : LOT SIZE

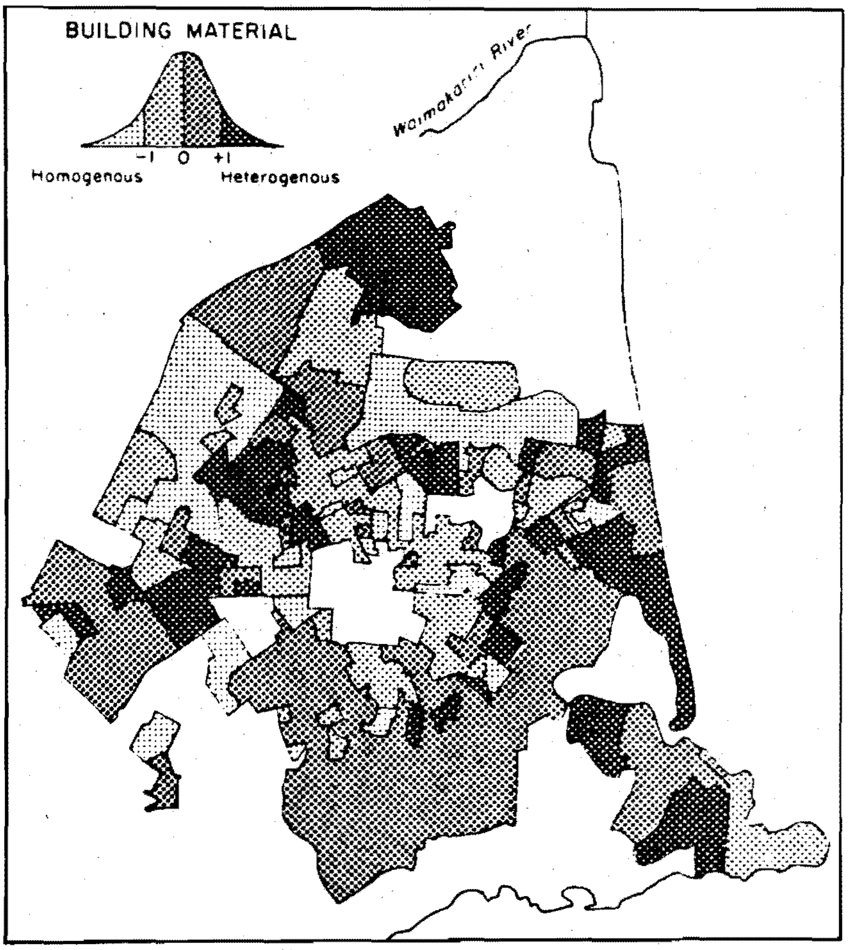


FIGURE 3.17 : WITHIN-AREA HOMOGENEITY : BUILDING MATERIAL

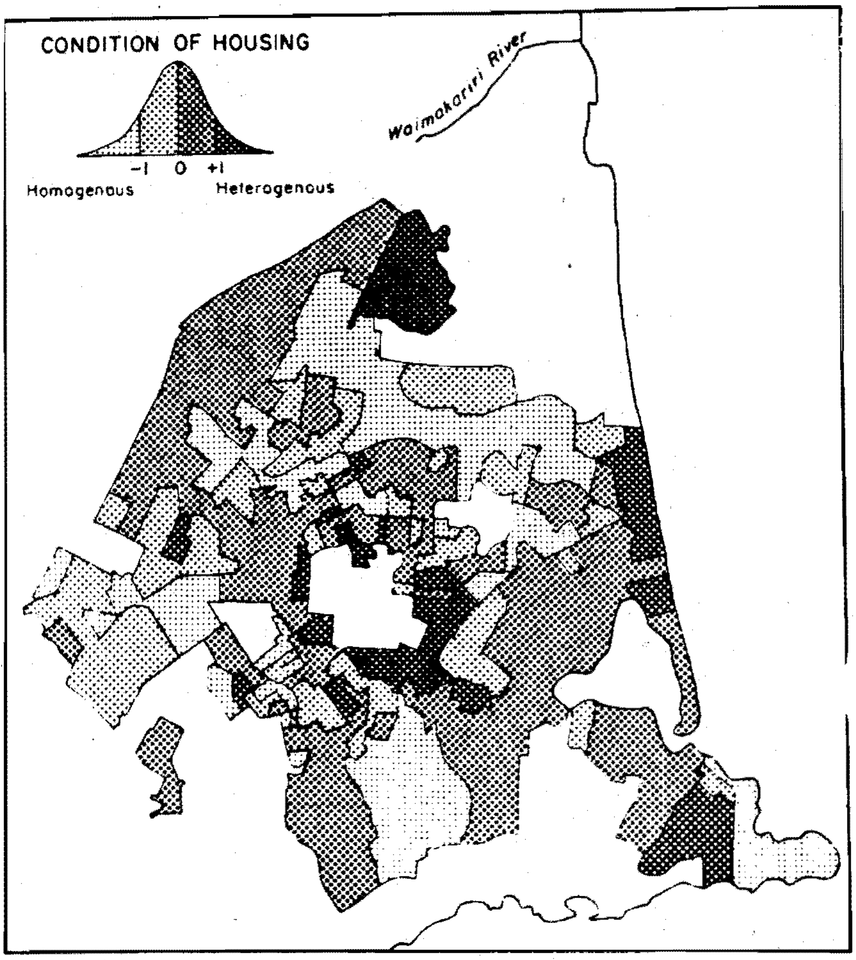


FIGURE 3.18 : WITHIN-AREA HOMOGENEITY :
CONDITION OF HOUSING

TABLE 3.3

INTERCORRELATION MATRIX

HOMOGENEITY MEASURES ON POPULATION AND HOUSING VARIABLES

AGE OF RESIDENTS	100										
MARITAL STATUS	84	100									
JOURNEY TO WORK	47	56	100								
INCOME	66	69	16	100							
OCCUPATION	19	18	-41	41	100						
PROPERTY VALUE	54	46	-01	59	39	100					
LOT SIZE	48	40	14	45	12	56	100				
AGE OF HOUSE	53	37	10	41	09	51	54	100			
CONDITION OF HOUSE	29	29	20	24	-04	17	21	32	100		
BUILDING MATERIAL	31	22	08	21	-13	26	24	35	06	100	
HOUSE SIZE	63	63	14	71	39	71	54	46	28	15	100

factoring of the intercorrelation matrix. The resultant component structure (see Table 3.4) indicates a three-dimensional homogeneity structure for the residential areas of Christchurch. From an inspection of the component loadings, the three dimensions may be labelled as follows:

1) social status (high loadings on occupation, income, house size and house value)
2) life cycle (high loadings on age of residents, marital status and mode of journey-to-work)
3) housing (high loadings on lot size, age of house and building material).

The spatial patterns produced when component scores on each multivariate homogeneity dimension are mapped (see Figures 3.19 to 3.21) reinforce many of the comments directed earlier at the univariate patterns. Within-area variation in social status is greatest in the higher status residential areas. There is a distinct city-suburb difference in the variation of life cycle characteristics within residential subareas; a pattern which is reinforced by an alighment of the mode of journey-go-work on this component. Alternatively, one may be isolating a basic city-suburb variation common to all urban areas - variation which is a direct expression of the growth of the city.

The increase in homogeneity of an area's population (and in particular, life cycle) characteristics with distance from the centre is demonstrated in Table 3.5. As far as the housing dimension is concerned, some form of spatial regularity is more difficult to discern. The most recently developed areas exhibit the greatest degree of homogeneity. At the other extreme, areas with greatest

TABLE 3.4

HOMOGENEITY STRUCTURE

CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	H^2
OCCUPATION	83			82
HOUSE SIZE	76			77
PROPERTY VALUE	71			73
INCOME	73			74
AGE OF RESIDENTS		69		82
MARITAL STATUS		78		87
JOURNEY TO WORK MODE		90		87
LOT SIZE			60	57
AGE OF HOUSE			73	67
BUILDING MATERIAL			78	62
CONDITION				23
CUMULATIVE % VARIANCE	28	51	70	

*VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS OVER 50 INCORPORATED IN TABLE
VALUES ON EACH VARIABLE ARE INDICES OF QUALITATIVE VARIATION (RANGE : 0-100)

COMPONENT LABEL
1. SOCIAL STATUS
2. LIFE CYCLE
3. HOUSING

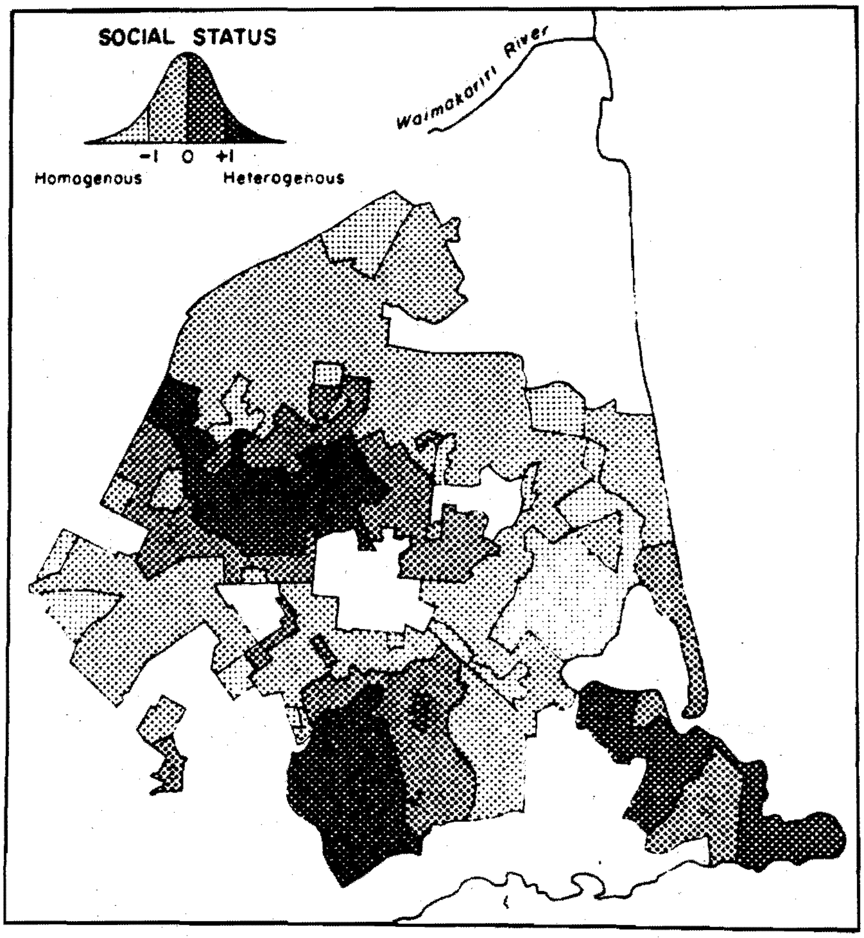


FIGURE 3.19 : WITHIN-AREA HOMOGENEITY : SOCIAL STATUS

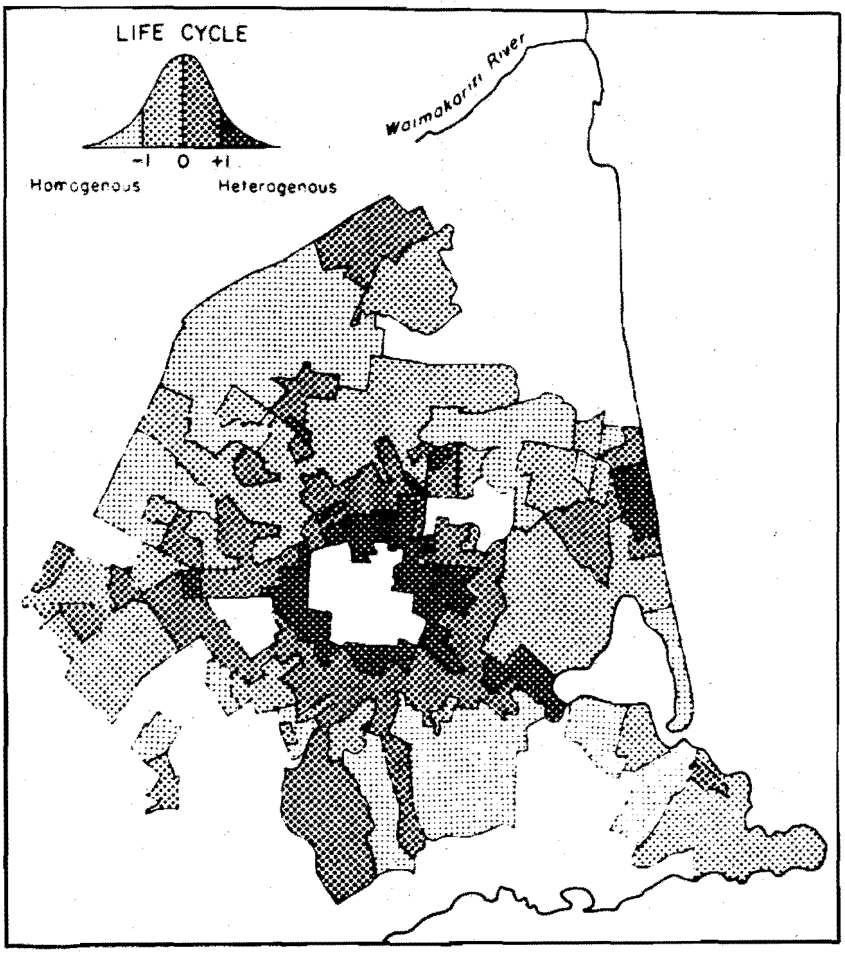


FIGURE 3.20 : WITHIN-AREA HOMOGENEITY : LIFE CYCLE

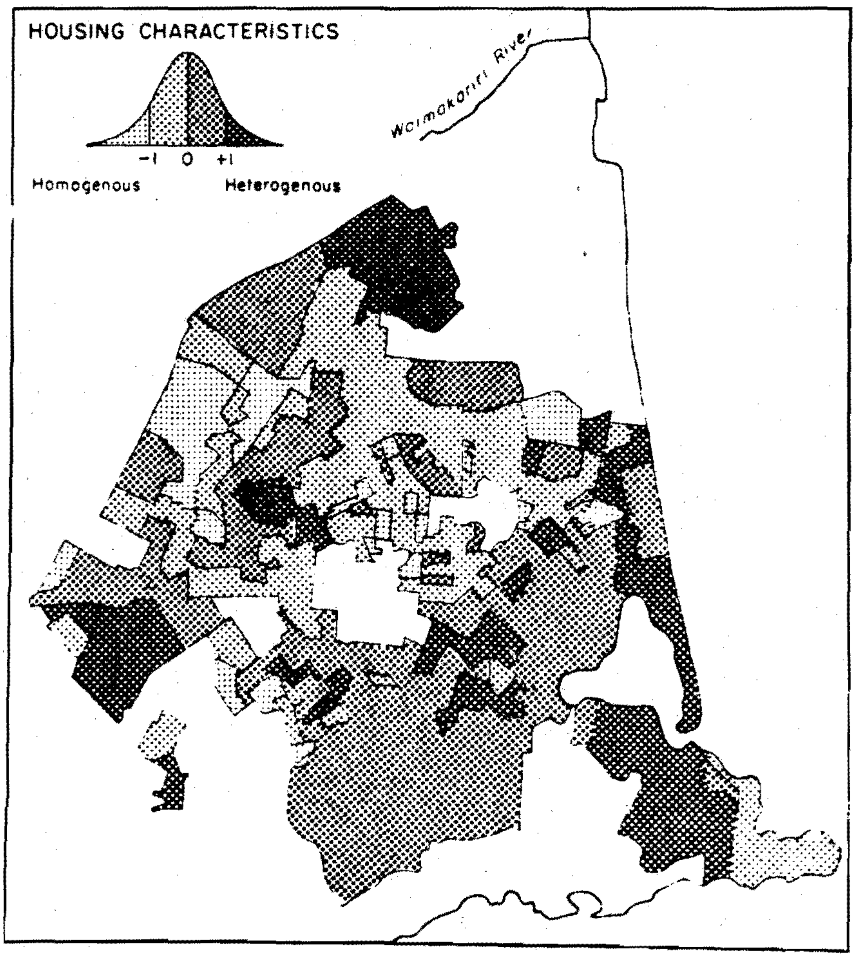


FIGURE 3.21 : WITHIN-AREA HOMOGENEITY :
HOUSING CHARACTERISTICS

TABLE 3.5

CORRELATION OF HOMOGENEITY MEASURES WITH URBAN INDICATORS

	AREA OF C.D.	DISTANCE TO CBD	POPULATION OF C.D.	POPULATION DENSITY
AGE OF RESIDENTS	-26	-52	-33	12
MARITAL STATUS	-30	-55	-29	29
JOURNEY TO WORK	-29	-48	-19	35
INCOME(MALE)	-15	-36	-23	07
OCCUPATION(MALE)	-07	-14	-02	-01
PROPERTY VALUE	03	-12	-09	-15
LOT SIZE	08	-11	-16	-20
AGE OF HOUSE	-01	-17	-23	-17
CONDITION OF HOUSE	-08	-15	-15	08
BUILDING MATERIAL	04	16	-12	-20
HOUSE SIZE	-01	-23	-21	-08

variation in section and housing attributes are those peripheral areas possessing cores of earlier settlement which are now being added to by new construction (e.g. Hornby, Halswell, Belfast, north and south New Brighton and the hill suburbs overlooking the estuary). Section subdivision and the replacement of obsolete housing by new construction, accounts for the mixture of housing to be found in the more central areas of Merivale, Barrington, Opawa and St. Martins.

To provide a more general pattern of the overall homogeneity or heterogeneity of Christchurch's residential areas all eleven population and housing variables were subjected to hierarchical classification (Beavon, 1972; Beavon and Hall, 1972) in an attempt to identify subareas with similar profiles of within-area variation. The resulting dendrogram (Figure 3.22) indicates that the majority of the 250 census districts[13] incorporated in the analysis are allocated to one of two groups. When the members of both groups are mapped (see Figure 3.23) a clear city-suburb division is apparent, revealing that the greatest mixture of housing and population characteristics is to be found in the central areas of a city, with greater levels of homogeneity being attained in the newer, outer suburban locations.

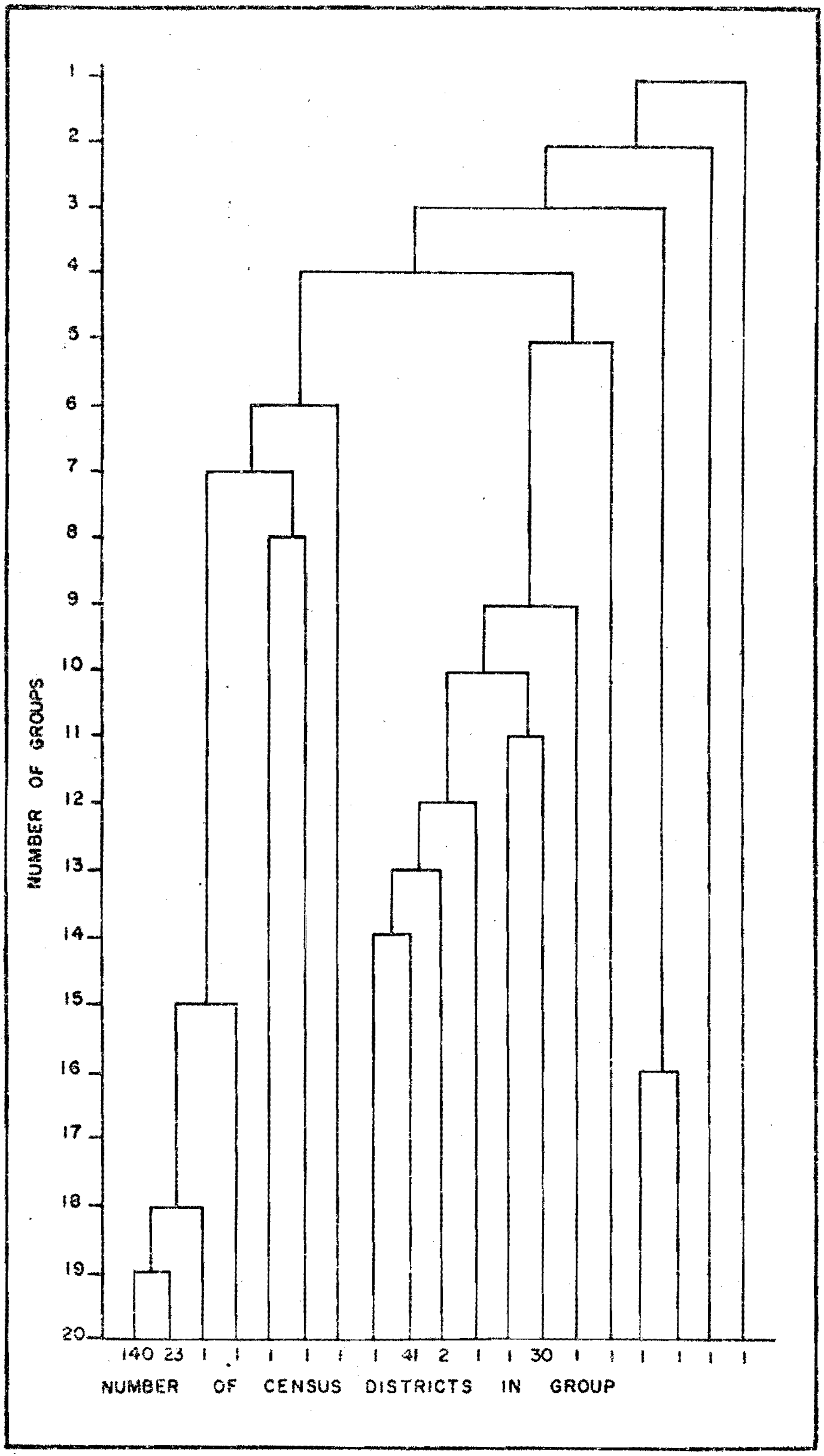


FIGURE 3.22 : CLASSIFICATION OF CHRISTCHURCH CENSUS DISTRICTS ACCORDING TO HOMOGENEITY PROFILES

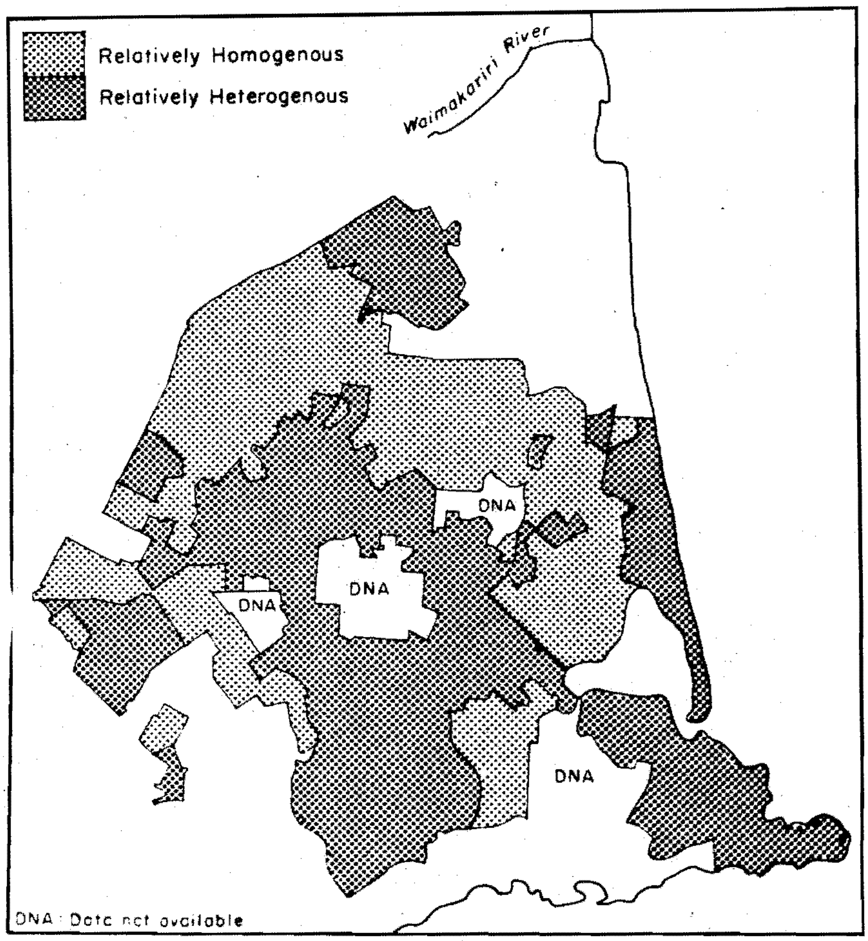


FIGURE 3.23 : CHRISTCHURCH : GENERALISED HOMOGENEITY - HETEROGENEITY GROUPS

SUMMARY

Two objectives were established at the outset of the present chapter.
The first of these concerned an identification of the major dimensions of Christchurch's existing housing structure. To this end, 25 housing indicators were subjected to principal axes analysis, revealing that the following component structure was sufficient to characterise the major aspects of Christchurch's housing stock:

1) the value of housing,
2) the quality of housing,
3) dwelling type,
4) State housing, and
5) vacant urban land.

In the process an aspatial grouping of dwelling and neighbourhood attributes (i.e. housing submarket types) was achieve.d Such groupings have direct counterparts in household demand functions.

The spatial patterning of housing submarkets was also examined by mapping component scores from the principal dimensions of Christchurch's housing structure. The need for housing submarkets to be additionally characterised by their location within the city is also recognised. A grouping of census districts into submarkets under contiguity constraint (see Openshaw, 1974; Taylor, 1969) is undertaken in Chapter 5.

The second part of the chapter sought to determine the level of within-area variation in population and housing attributes which characterised Christchurch's residential subareas. It was established that the predictive efficiency of locational choice models to be formulated and tested later in the thesis will rest heavily on the heterogeneity of the city's residential districts. It is proposed that where regression analysis is employed as the statistical model in locational choice analysis, a test of the influence of heterogeneity on model performance could be achieved by correlating a household's residual from regression (i.e. its actual destination area score minus its predicted destination area score), with the level of homogeneity in its destination area. Alternatively, the level of heterogeneity within a census district could be introduced into a final set of residential sub-area classifications (see Chapter 5) thereby 'building in' an allowance for heterogeneity within the locational choice models.

NOTES

1 See Berridge (1971) for a recent review.

2 This propostion is embodied in Multivariate Analysis and Residential Property Values (1970).

3 Whether individual or aggregate data is chosen for submarket analysis depends largely on the nature of the research problem.

4 For example: Katona and Mueller (1962); Bracey (1964); Weiss, Kenney and Steffens (1966); Abu-Lughod and Foley (1960); Foote et al. (1960); Daly (1968, 1970); Butler et al. (1969); and Lansing, Mueller and Barth (1964).

5 The variables extracted from 1974 valuation listings were: land value, house value, capital value, area of section, landuse zone, number of units on the section, percent of section subdivisable, number of garage spaces, age of building, condition of building, building materials and floor area.

6 Categories Available for Housing Submarket Analysis

Variable	Number of Categories	Description of Categories
1. Land value ($)	7	% < 2000; 2000-3999; 4000-5999; 6000-7999; 8000-9999; 10000-12999; > 30000
2. House value ($)	7	% < 5000; 5000-9999; 10000-14999; 15000-19999; 20000-24999; 25000-29999; > 30000
3. Capital or Property value ($)	7	% < 7000; 7000-11999; 12000-16999; 17000-21999; 22000-26999; 27000-31999; > 32000
4. Area of Section (perches)	7	% 1-20; 21-27; 28-35; 36-40; 41-80; 81-160; > 160
5. Zone	1	% Residential
6. Number of Units on Section	5	% 1; 2; 3-5; 6-10; >10
7. Percent of Section Subdivisable	6	% zero; approx. 20; approx. 40; approx. 60; approx. 80; approx. 90
8. Garage spaces	3	% none; 1; > 1
9. Age of building (decade of construction)	8	% Pre 1900; 1910's; 1920's; 1930's; 1940's; 1950's; 1960's; 1970's
10. Condition of building	4	% Poor; Fair; Average; Good.
11. Building materials	3	% Brick-stone; weather-board; other
12. Floor area	7	% 1-9; 10-14; 15-19; 20-24; 25-29; 30-34; > 35.

An example of the complete data set held by the Valuation Department for individual properties in Christchurch is given in Appendix III.1.

7 Additional information on valuation equalisation can be found in the New Zealand Official Yearbook, 1973, pp. 284-287. The following table provides the date at which Christchurch's county and borough valuation rolls were revised and the equalisation index by which a property's capital value (C.V.) was adjusted. The Waimairi county revision date was taken as the base for equalisation as it most closely approximated enumeration for the 1971 census.

Valuation Equalisation

Local Area	Date of Last Revision of Capital Value	Equalisation
Waimairi County	1/2/1971	-
Christchurch City	1/11/1969	21% increase in C.V.
Heathcote County	1/11/1970	5% increase in C.V.
Riccarton Borough	1/11/1971	15% decrease in C.V.
Paparua County	1/7/1972	30% decrease in C.V.

8 There were, in fact, several areas for which valuation and landuse information was not available at the time of data extraction (these areas remain blank on Figures 3.1 to 3.5 and Figures 3.8 to 3.21).

9 Achieved by mapping the component scores.

10 Unlike some areas in Auckland and Wellington; see Housing in New Zealand (1971).

11 For a fuller treatment of multi-unit residential development in Christchurch, see Nahkies (1974).

12 A more detailed outline of the statistic can be found in Mueller and Schuessler (1961, pp. 174-179).

13 Analysis was limited to 250 census districts due to restrictions on array size by the University's B6718 computer.

CHAPTER FOUR

THE NATURE OF CHRISTCHURCH'S VACANCY MARKET

Residential mobility studies to date have almost totally neglected the role of the vacancy market when considering the outcome of an intra-urban move. An exception is Simmons (1968, p.637), who recognises this constraint on mobility when he states that

> *The selection of a new home depends not only on demand conditions (the priorities that the family assigns to different housing characteristics) but also on supply constraints (the cost and quality of different types of housing in different parts of the city).*

Brown and Longbrake (1970) also draw attention to the role of the spatial characteristics of the vacancy market in directing intra-urban migration. Unfortunately, the brief references made by the latter workers to the relationship between housing vacancies and patterns of aggregate population movement within Cedar Rapids are at best, post hoc explanatory sketches.

Sufficient evidence exists, however, to suggest that vacancy rates are not uniform throughout an urban area; nor are they constant for particular categories of housing (see Winger, 1967; Newton, 1975a; Moreton and Tate, 1975). As an extension to the previous chapter where the focus centred on the existing stock of housing within Christchurch, the present paper is concerned with the nature (structure and spatial distribution) of the city's vacancy market[1] during 1974.

Vacancy submarkets are considered as distinct from housing submarkets in terms of the opportunity they (the vacancy submarkets) present for intendedly mobile households to satisfy their housing needs and preferences. For example, the 'high quality-high price' housing submarket of a particular city may be found to occupy three separate locations (say, three suburbs), but for the particular period in which a group of households are engaged in residential search, the 'high quality-high price' vacancy submarket is spatially restricted to only one of the three potential locations. Consequently, if relocation is to occur during that time period and an 'executive' home in a high prestige area is an important requirement for the mover households, a spatial bias will be imparted to the residence-shifts in the direction of the single 'high quality-high price' vacancy submarket.

Determination of the structure and pattern of Christchurch's vacancy market will enable the assumption of uniform distribution of vacancies (an assumption tied to residential location models based on existing, but not necessarily vacant housing stock) to be relaxed for a number of the models formulated in Part B. From the point of view of efficiency, an allocation model based on the distribution of existing housing stock is to be preferred (given the availability of such data). But a large proportion of intra-urban moves occur in response to available vacancies, and if available vacancies are atypical of housing stock in the set of destination areas, an allocation model based solely on existing stock is likely to generate an unacceptable level of misallocations.

SOME ISSUES IN VACANCY MARKET ANALYSIS

A city's total supply of available single family housing units for any period in time is characterised by existing housing units vacated by mover households as well as new construction. Weiss, Smith, Kaiser and Kenney (1966) have identified a number of the principal agents in the property development process[2], all having their respective influence on the vacancy market of a city. For the purposes of the present study, however, they are to be viewed simply as the undifferentiated suppliers of vacant dwellings.

The total supply of vacant housing can be differentiated in a similar manner to that used when indexing the existing housing stock - by employing variables such as: tenure, price range, number of rooms (particularly number of bedrooms), age, condition, location, type of dwelling, etc. Vacancy submarkets subsequently derive from a division of the total available housing stock into several relatively homogeneous groups according to one or more of the abovementioned variables.

Whether to use more than one variable to index a particular submarket type is a debatable issue. Derivation of univariate submarkets is unrealistic both from the point of view of the nature of housing and the nature of household demand for housing. Housing is a multivariate commodity and individual aspirations or preferences or demands for housing are similarly multivariate (see Christen, 1973; Johnston, 1973d; Flowerdew, 1973; Menchik, 1971; Peterson, 1967). It is also most probably that for any given vacancy (or vacancy submarket), many dwelling and locational attributes will be closely associated with one another. For example, a vacancy submarket characterised by houses priced over $35,000 is also likely to possess dwellings with three or more bedrooms, be built of permanent materials, in good physical condition and in areas of medium-to-high residential status. Conversely, submarkets of low priced housing could be expected to comprise dwellings in need of repair, technologically obsolescent, with fewer rooms, and in areas of mixed landuse. Housing 'bundles' such as these form the basis for residential locational choice models derived in Part B. It remains, however, to determine the precise nature of such vacancy submarkets and their location(s) within Christchurch.

Before proceeding with such analyses, there is one further caveat to be considered. This involves the behaviour of a city's vacancy market over time. Uulike the distribution of a city's population and housing stock, which is subject, in most cases, to very gradual change over time, the nature and location of vacant housing may be subject to marked change even over a short time period. The shorter the period involved in an analysis of vacancy patterns - for example, day to day or week to week changes - the greater is the likelihood for variation not only in the types of dwelling coming onto the market but in addition, their location within the city.

Choice of a level of temporal aggregation to adopt in an analysis of Christchurch's vacancy market poses as many problems as that in spatial aggregation. On *a priori* grounds, one could expect the vacancy market to be subject to seasonal variations, but there are no studies to substantiate this.

A preliminary assessment of stability in numbers and types of vacancies appearing on the market in Christchurch in 1974 is undertaken by studying the vacancy reserve for two periods: January-June and July to October. Initially, perhaps, one should begin by probing for differences in vacancy submarket structures and patterns at monthly intervals, aggregating temporally on the basis of similarities in housing reserves at these lower temporal levels. However, should variations in the structure and distribution of vacancies emerge as a result of investigations at the somewhat grosser scale of four and six-monthly intervals, a case may exist for developing separate models comprising households who relocated during different periods in the year.

THE DATA BASE FOR VACANCY MARKET ANALYSES

Two principal sources of information exist for obtaining a comprehensive coverage of data on vacant properties:

1) the Multiple Listing Service[3] (MLS), and
2) the classified advertisements in the local newspaper.

Examples of the type of information contained in both data bases are presented in Appendix IV.1. It is apparent that a much greater amount of factual information is contained on the multiple listing cards (e.g. size of section, number of rooms, number of bedrooms, age, building material, market price, government valuation, rates, an exact address, and a photograph of the property and its immediate surroundings). In comparison, many of the newspaper advertisements are flamboyantly written, for example,

> *Magnificently built town house with luxurious shag pile carpet and intriguing fittings. Mature, exhilirating setting .... A real steal at $27,000.*
>
> *(Christchurch Press 12/10/74)*

and convey little objective information.

Another problem concerns the lattitude used by real estate agents to describe the location of certain properties - especially those adjacent to high prestige areas (similar comments have been made by Congalton, 1969, in connection with advertisements for property in Sydney). It is also difficult to detect the situation where the same property is being advertised concurrently by different estate agencies - and a failure to isolate these cases tends to inflate the pattern of vacancies for the areas concerned.

Given the problems associated with newspaper advertisements, it is clear that MLS data has a number of advantages for vacancy market analysis. One question remains: how representative are the MLS properties of all vacant property on the market for any period of time? A study by Becker (1972) in Oakland, California examined this particular issue and concluded that there was little difference between MLS and non-MLS homes in terms of home value (the sole variable inspected).

In Christchurch, at least 70 percent of all marketable properties for the first nine months of 1974 were advertised through MLS[4]. This provides an initial indication of its coverage, although not necessarily its representativeness for all areas or for most types of property.

An assessment of the extent to which there was agreement between the spatial distribution of vacant properties advertised in the newspaper or via MLS was made by comparing the vacancy reserve estimated from both sources for the period January-October 1974[5]. A complete set of MLS cards and all Saturday issues of the Christchurch Press for this ten month period provided the data for the analyses which follow.

An allocation of vacant properties to census subdivisions within the city[6] permitted the following comparisons to be made. The areal distribution of vacancies advertised through The Press (see Figure 4.1) showed little evidence of fluctuation for the two time periods considered (January-June and July-October) - a fact which is reflected in the high correlations contained in Table 4.1. What is evident is the high concentration of advertisements in a small number of areas - areas which would not be expected to display such a high turnover of ownership property: in particular, Cashmere, Fendalton, Avonhead and St. Albans (and to a lesser extent, Ilam, Papanui, Riccarton, Hornby, Linwood and Avondale). At least two factors could be responsible for such a pattern. Firstly, vacant property which is located adjacent to a high status area (several of which are

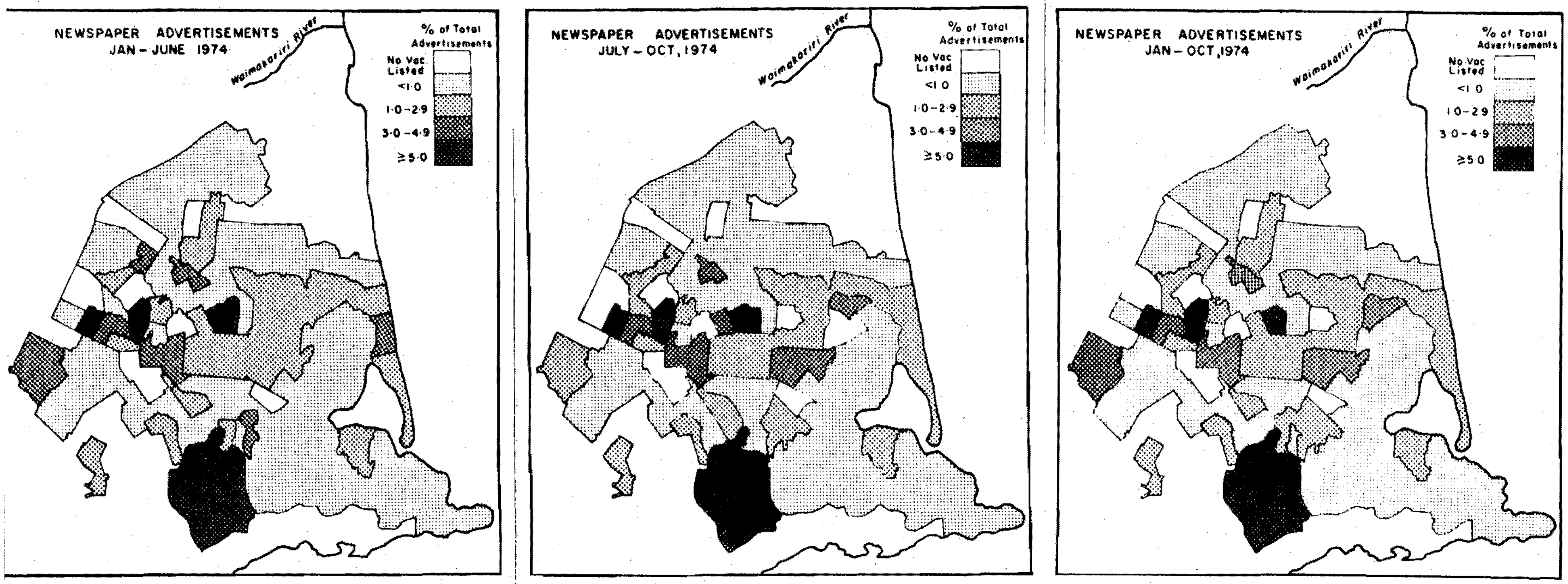


FIGURE 4.1 : DISTRIBUTION OF VACANT PROPERTIES WITHIN CHRISTCHURCH : NEWSPAPER SOURCE

listed above) is liable to be advertised as being within the 'bounds' of the higher prestige suburb (a form of 'neighbourhood effect'). The marked absence of vacancies in the areas surrounding high status/high vacancy nodes may be attributable to this fact[7]. Secondly, it proved difficult to completely remove the effect of duplicate advertisements occurring either on the same day (placed by different real estate agencies) or on following weeks (if the property remained on the market). Re-advertisement of properties would also appear to be more frequent the higher the value of the property.

In a similar manner to the previous analyses, properties listed on the MLS cards were assigned to census subdivisions. Since there was an exact address for each property and there were no repeated listings, two of the confounding features associated with coding newspaper advertisements is removed. The resulting patterns are presented in Figure 4.2. A reasonably consistent spatial distribution holds for the two time periods considered (refer also to Table 4.1) with a high concentration of MLS properties in the northern suburbs of the city. It also appears that there is not the same concentration of listed property in the higher status areas - a characteristic feature of the newspaper advertisements.

An indication of the correspondence which does exist between the spatial distribution of the MLS and newspaper vacancies is provided by the set of correlations in Table 4.1. Although there is a certain amount of fluctuation from one period to another, and from one information channel to another, the correlation of +0.74 between

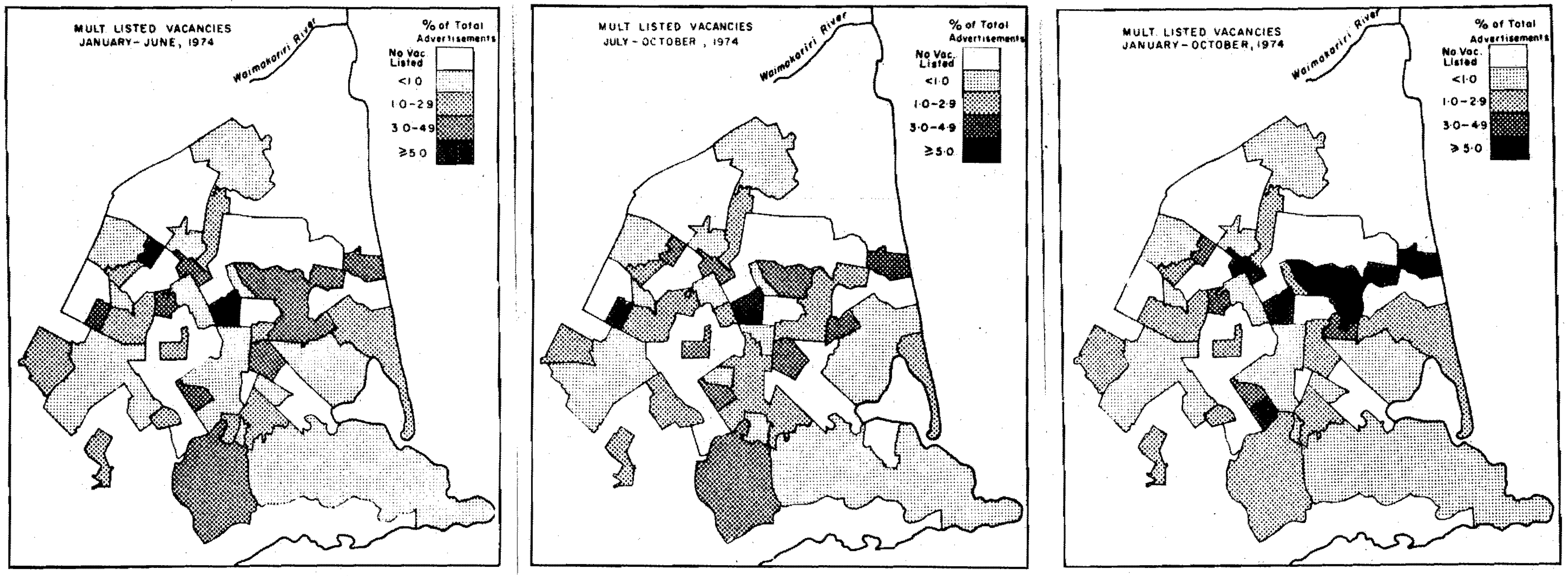


FIGURE 4.2 : DISTRIBUTION OF VACANT PROPERTIES WITHIN CHRISTCHURCH : MULTIPLE LISTING SOURCE

TABLE 4.1

INTERCORRELATION ANALYSIS
MLS LISTINGS VS. NEWSPAPER
ADVERTISEMENTS , 1974 *

MLS (JAN-JUN)	100					
MLS (JUL-OCT)	85	100				
ADS (JAN-JUN)	70	77	100			
ADS (JUL-OCT)	61	77	96	100		
ADS (JAN-OCT)	66	78	99	99	100	
MLS (JAN-OCT)	97	96	76	71	74	100

* BY CENSUS SUBDIVISIONS

MLS and newspaper vacancies for the period January-October provides a measure of the level of co-variation in the pattern of the vacancy reserve which derives from these two sources. In examining this relationship further, newspaper advertisements for all subdivisions for the period January-October were regressed against their counterpart MLS listings[9]. Residuals from the regression were mapped (Figure 4.3) to facilitate the identification of those areas where greatest deviation existed between the two data sources.

Areas of particular interest are those where there is a concentration of large residual values (i.e. residuals lying at distances beyond ± 1 standardized residuals). Apart from four isolated cells to the north and west of the city centre (St. Albans, Bishopdale, Avonhead and Fendalton), the largest concentration of 'deviant' areas is in a corridor to the northeast of the CBD. The juxtaposition of areas with high negative residuals (i.e. areas where there was a disproportionately large number of MLS listings compared with newspaper advertisements) and high positive residuals increases the difficulty of accounting for the different patterns. It does appear, however, that areas in which real estate agents find it more difficult to sell property are those which will feature more strongly on MLS listings. It is also likely that areas with high negative residuals are those where there has been a concentration (one which is, perhaps, unrepresentative of the total housing stock of the area) of less desirable property entering the market during the period of analysis.

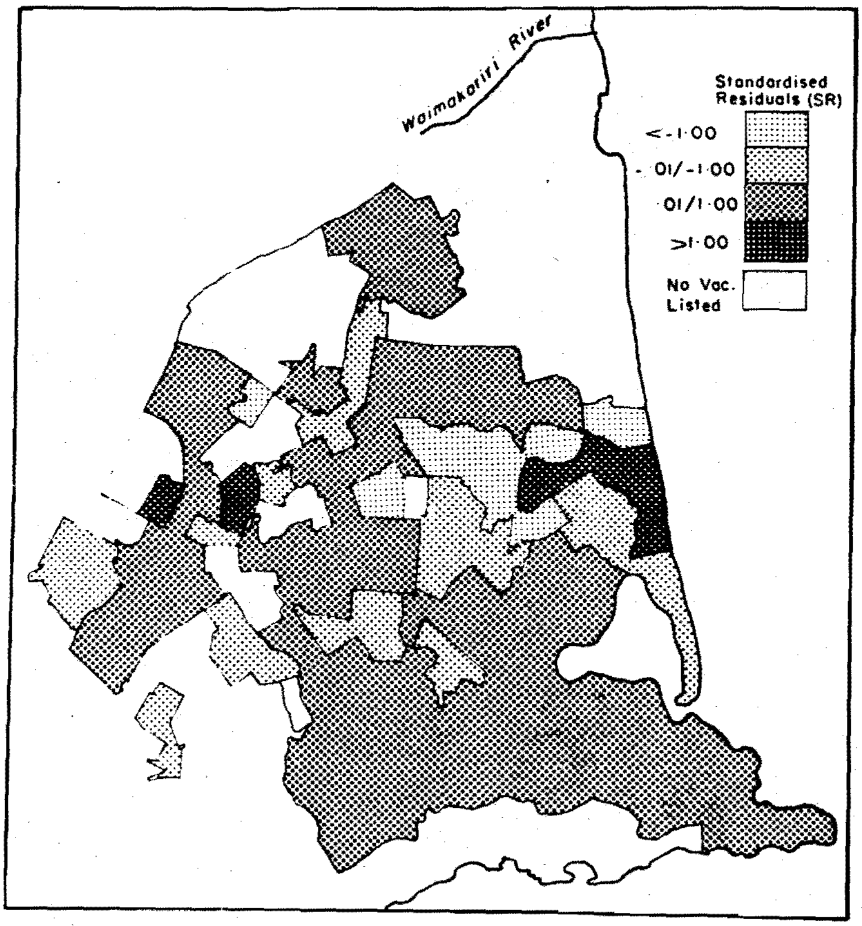


FIGURE 4.3 : RESIDUALS FROM REGRESSION : MLS VACANCIES VS. NEWSPAPER VACANCIES

While there is a reasonably high level of congruence between vacancies listed via MLS and the local newspaper for the majority of Christchurch's suburbs, there are a number of areas where vacancy estimates are at considerable variance with one another. It follows that in situations where the size of a subarea's vacancy reserve is entered as a component in a locational choice model, MLS values for certain areas may require rescaling. Implicit in the last statement is the decision to employ MLS listings as the data base for the analysis of Christchurch's vacancy market structure. The major reasons for this relate to the accuracy with which vacant properties can be located within the city together with the greater amount of objective information associated with each property. In many ways the newspaper advertisements constitute a data source for investigating the way in which real estate agents convey information about the vacancy market to potential movers (institutional mental maps?). A brief account of the results which emerge from an analysis of the content of the newspaper advertisements for the period, January-October 1974 is presented in Appendix IV.2.

In the section which follows, MLS data are analysed in an attempt to determine:

1) the number and types of vacancy submarket present in Christchurch in 1974;
2) the spatial distribution of the submarkets; and
3) the extent of temporal variation (if any) in the structure of the vacancy market during 1974.

THE CHRISTCHURCH VACANCY MARKET, 1974

Structure and Pattern

Principal axes analysis (with Varimax rotation) was used to identify the major components of Christchurch's vacancy market for the period January-October, 1974. Six meaningful submarket types were identified (see Table 4.2), which together account for 79 percent of the total variation among the 29 housing indices[10].

1) Ownership Flats

Submarkets indexed by this component are characterised by small section sizes, few rooms, and generally no more than two bedrooms. Although introduced initially to provide accommodation for households in the latter stages of life cycle, this particular type of dwelling is now in demand by households in the pre-child and child-bearing stages of the life cycle. The reason for this trend relates principally to the lower prices assocated with most ownership flats in comparison with the larger sections and floor areas of the single-family detached properties. The spatial distribution of this submarket type is represented in Figure 4.4[11]. What is apparent is the absence of any æeal concentration within the city. Instead, at most distances and directions from the centre of the city, and in areas of varying social status, opportunity does exist for a number of mover households to satisfy housing requirements which can be met specifically by the ownership flat.

2) Large, Old Houses

The vacancy submarket featuring large, older dwellings has a spatial distribution which reflects the ageing of housing in Christchurch (Figure 4.5).

TABLE 4.2

VACANCY MARKET STRUCTURE

CHRISTCHURCH, JAN-OCT 1974 *

VARIABLES	COMPONENTS 1.	2.	3.	4.	5.	6.	7.	8.	9.	H^2
% <20 PERCHES	-64									74
% 3 ROOMS	-89									89
% 2 BEDROOMS	-84									90
% 3 BEDROOMS	79									88
% OWNERSHIP FLATS	-78									91
% BUILT PRE 1910		-74								88
% 6 ROOMS		-85								87
% 4 BEDROOMS		-93								89
% >$35000			90							86
% 2 GARAGES			68							66
% GOOD APPEARANCE			88							91
% BUILT 1960'S				-84						88
% BUILT 1950'S				53						78
% $25-30000				-60						79
% AVE. APPEARANCE				-60						73
% BRICK					80					75
% WEATHERBOARD					78					68
% BUILT 1920'S						75				73
% $20-25000						-54				86
% 4 ROOMS						-63				87
% 5 ROOMS						64				72
% 30-39 PERCHES							-51			68
% >50 PERCHES							-53			65
% BUILT 1970'S							67			57
% BUILT 1940'S							59			65
% $15-20000								53		81
% $30-35000								-85		77
% $10-15000									79	81
% BUILT 1910'S										51
CUM. % VARIATION	13	24	34	42	50	59	67	74	79	
EIGENVALUE	5.1	3.8	3.2	2.6	2.0	1.9	1.7	1.3	1.2	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS

LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. OWNERSHIP FLATS
2. LARGE, OLD HOUSES
3. GOOD QUALITY, HIGH COST HOUSING
4. MEDIUM TO HIGH QUALITY HOUSES
5. BUILDING MATERIALS
6. MODERATE SIZED, OLDER STYLE, MEDIUM PRICED DWELLINGS

7, 8, 9. - NOT LABELLED

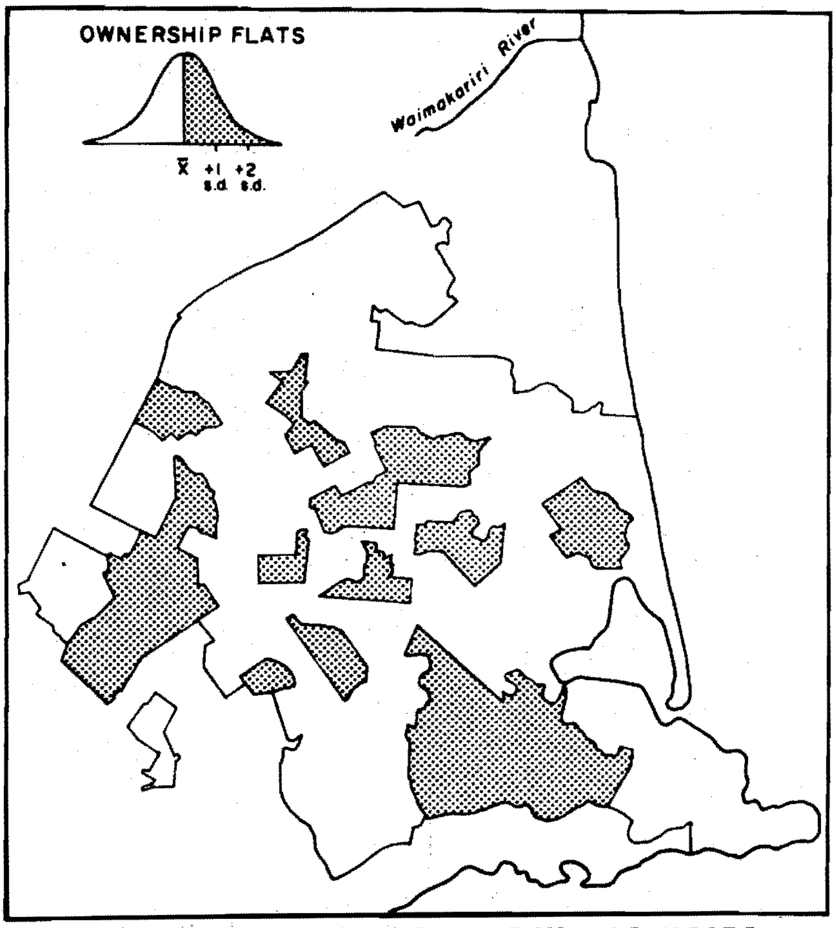


FIGURE 4.4 : CHRISTCHURCH VACANCIES : OWNERSHIP FLATS

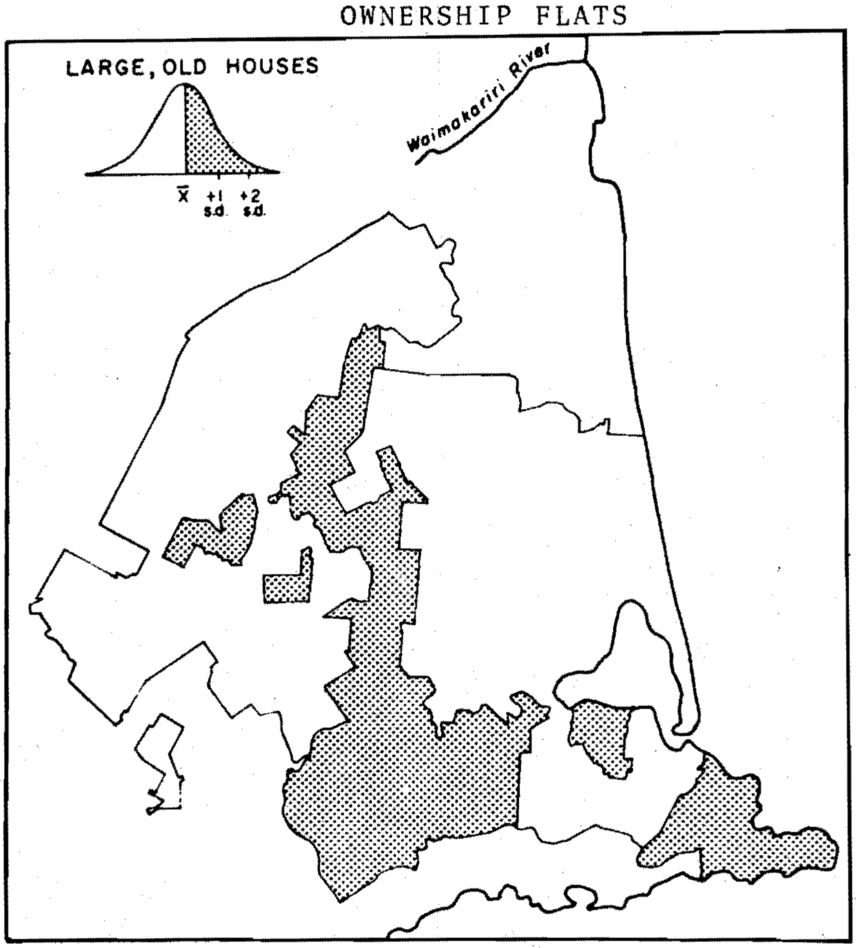


FIGURE 4.5 : CHRISTCHURCH VACANCIES : LARGE, OLD HOUSES

In addition to the concentration of this type of vacant housing in the central city areas, there is an extension along major transportation arteries to the north, west and south of the CBD. In most instances, such property is prime for either redevelopment (conversion to commercial or industrial landuse) or renewal (usually at a higher residential density).

3) <u>Good Quality, High Cost Housing</u>

With high positive loadings on 'good appearance', 'two garages' and '> $35,000', the third component identifies the high prestige vacancy submarket comprising good quality, high cost housing (Figure 4.6). Most of the submarkets are located in high status areas to the northwest of the city centre or on the Port Hills. Areas which appear to have a higher proportion of good quality <u>vacant</u> dwellings than is typical of their entire existing stock include Halswell, Sumner, Mairehau and Riccarton. It is in a situation such as this (i.e. when an area's vacant housing for a particular period is atypical of the overall stock) that the involvement of the vacancy market structure - in addition to the housing market structure - in models of residential locational choice should result in a higher level of correct predictions of move outcomes.

4) <u>Medium to High Quality Houses</u>

The stock of what could be classed as medium/high quality (based on market price, age and physical appearance) vacant housing has a considerably wider areal base than the previous submarket type (Figure 4.7). The range of housing which exists in most of the high status residential areas of Christchurch is reflected in the

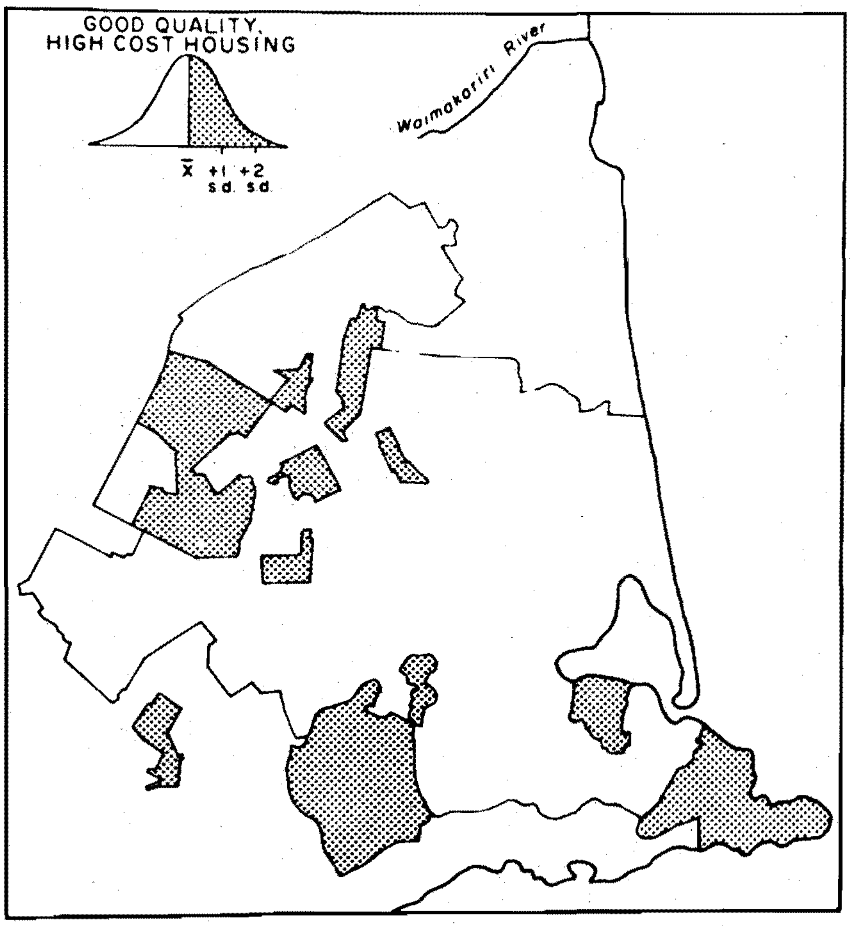


FIGURE 4.6 : CHRISTCHURCH VACANCIES :
GOOD QUALITY, HIGH COST HOUSING

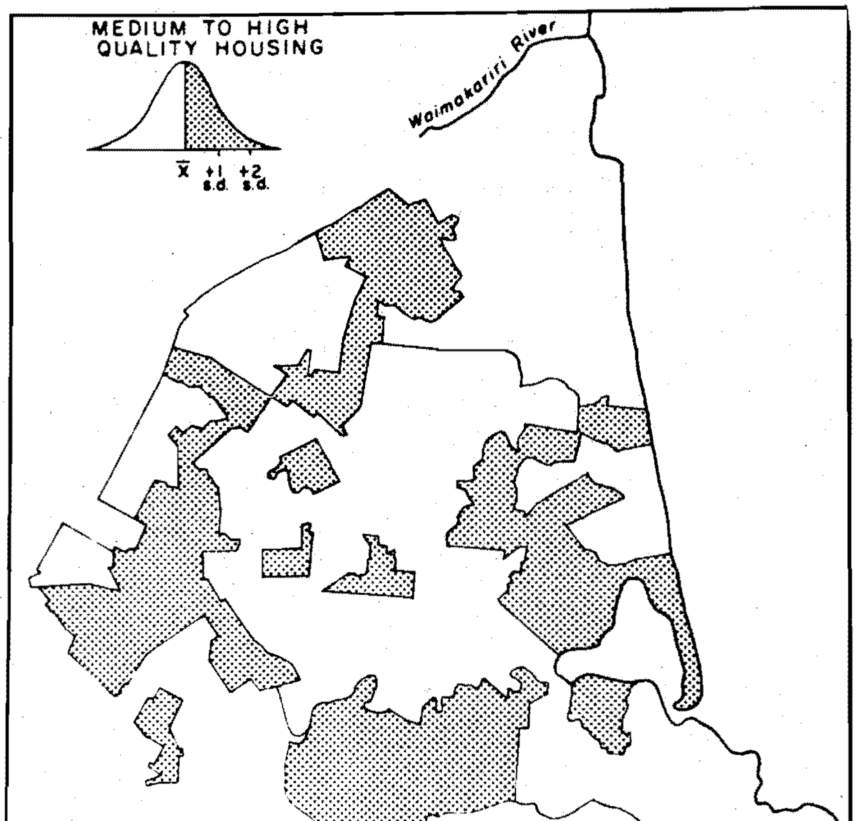


FIGURE 4.7 : CHRISTCHURCH VACANCIES :
MEDIUM TO HIGH QUALITY HOUSING

spatial distribution of this submarket type - with medium-priced property co-locating with higher cost housing. Other areas with a high proportion of medium-priced property include several suburbs to the east of the city centre (e.g. Burwood, Avonside, Bromley, South Brighton) as well as a number in residential districts on the southwestern outskirts of the urban area (namely, Hoon Hay, Hillmorton, Sockburn, Hornby and Halswell).

5) Building Materials

An inspection of the loadings on this component reveals that both the major building materials, brick (or any permanent material) and westherboard index this submarket type. This would indicate that in the majority of areas, there was a similar proportion of vacant dwellings of brick and weatherboard construction which entered the market during January-October, 1974. Such a dimension does not usefully discriminate between the stock of vacant housing and as a consequence would make little or no contribution to any locational choice model.

6) Moderate Sized, Older Style, Medium Priced Dwellings

The last vacancy submarket type to be labelled identifies two classes of housing which appear to occupy similar spatial locations. On the one hand, there are the rather large properties which were built prior to the second world war, while on the other, there are the smaller (and possibly somewhat newer) houses which are priced in the region of $25,000. This type of submarket has numerous locations throughout Christchurch (see Figure 4.8). Again there is evidence of lower value and lower quality housing in existence and entering the

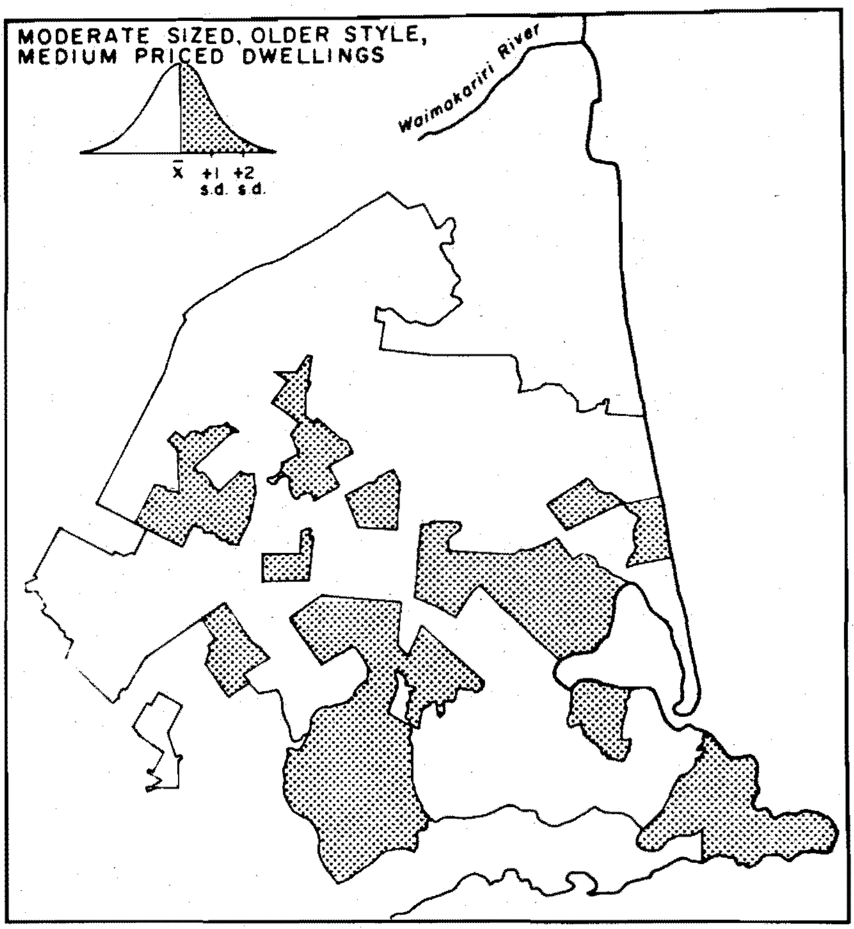


FIGURE 4.8 : CHRISTCHURCH VACANCIES :
MODERATE SIZED, OLDER STYLE,
MEDIUM PRICED DWELLINGS

market in what are considered to be some of the higher status areas in the city (refer to the homogeneity analyses in Chapter 3).

Temporal Invariance of Vacancy Submarket Structure

Over a ten month period from January-October 1974 the types of vacancy submarket outlined in the previous section represent the major groups of housing to enter the city's property market. What is not clear, however, is the extent to which the type of housing which entered the market remained constant throughout the period of analysis.

A preliminary assessment of the degree of temporal invariance inherent in Christchurch's vacancy submarket structure is obtained by segmenting the ten month period into a six month (January-June) and a four month (July-October) period. The vacancy submarket structures for these two periods are presented in Tables 4.3 and 4.4. Inspection of these tables in conjunction with Table 4.5 which presents the results of tests of the stability of the component structures)[12] reveals that the vacancy structure for January-June is closely aligned with the vacancy structure for the entire ten month period. Similar levels of congruence do not hold when the July-October period is considered, however. This suggests that a slightly different type of housing was entering the market between July-October either in place of or more likely (given the magnitude of the cosines) in addition to the type of vacancies which characterised various sub-areas of Christchurch during the first six months of the year. This result is again indicative of a reasonably heterogenous housing stock within

TABLE 4.3

VACANCY MARKET STRUCTURE
CHRISTCHURCH, JAN-JUN 1974 *

VARIABLES	1.	2.	3.	4.	5.	6.	7.	8.	9.	H^2
% BUILT 1960'S	89									89
% BRICK	80									86
% WEATHERBOARD	-73									85
% <20 PERCHES		67								79
% 3 ROOMS		87								87
% 2 BEDROOMS		86								88
% 3 BEDROOMS		-76								88
% OWNERSHIP FLATS		79								88
% >$35000			84							77
% 2 GARAGES			62							69
% GOOD APPEARANCE			95							94
% BUILT PRE 1910				-62						87
% 6 ROOMS				-82						83
% 4 BEDROOMS				-92						91
% BUILT 1920'S					51					72
% $20-25000					-67					84
% 4 ROOMS					-69					83
% 5 ROOMS					62					73
% >50 PERCHES						-53	-57			68
% BUILT 1970'S						65				67
% BUILT 1940'S						79				67
% $15-20000							62			87
% $30-35000							-83			77
% 30-39 PERCHES								-55		65
% $25-30000								-70		80
% AVE. APPEARANCE								-61		76
% $10-15000									91	92
% BUILT 1910'S										64
% BUILT 1950'S										60
CUM. % VARIATION	12	26	36	46	54	62	69	76	81	
EIGENVALUE	5.3	4.5	3.2	2.6	1.9	1.7	1.5	1.3	1.2	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. BUILDING MATERIALS
2. OWNERSHIP FLATS
3. GOOD QUALITY,HIGH COST HOUSING
4. LARGE,OLD HOUSES
5. MODERATE SIZED,OLDER STYLE,MEDIUM PRICED DWELLINGS

6,7. - NOT LABELLED

8. MEDIUM TO HIGH QUALITY HOUSES
9. -NOT LABELLED

TABLE 4.4

VACANCY MARKET STRUCTURE

CHRISTCHURCH, JUL-OCT 1974 *

VARIABLES	COMPONENTS 1.	2.	3.	4.	5.	6.	7.	8.	9.	H^2
% <20 PERCHES	93									91
% BUILT 1970'S	86									82
% 2 BEDROOMS	59			-63						83
% 3 BEDROOMS	-53			60						87
% OWNERSHIP FLATS	95									93
% BUILT 1910'S		-82								78
% BUILT PRE 1910		-89								87
% $10-15000		-81								81
% >50 PERCHES			71							81
% $20-25000			-53							62
% >$35000			72							87
% GOOD APPEARANCE			91							88
% BUILT 1960'S				50						91
% BUILT 1940'S				-89						85
% $15-20000				-76						74
% 3 ROOMS				-76						91
% 4 ROOMS					65					87
% 5 ROOMS					-81					71
% 6 ROOMS						84				73
% 4 BEDROOMS						93				90
% BUILT 1950'S							85			85
% $30-35000							75			85
% 2 GARAGES							50			60
% BUILT 1920'S								-65	50	83
% BRICK								87		92
% WEATHERBOARD								-88		86
% 30-39 PERCHES									56	70
% $25-30000										78
% AVE. APPEARANCE										85
CUM. % VARIATION	14	24	34	47	55	62	68	76	83	
EIGENVALUE	6.8	3.6	3.1	2.2	2.1	2.1	1.8	1.5	1.1	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS OVER 50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. OWNERSHIP FLATS
2. OLD, LOW COST HOUSING
3. GOOD QUALITY, HIGH COST HOUSING
4. MEDIUM COST HOUSING

5, 6 NOT LABELLED

7. OLDER, HIGH PRICED HOUSING
8. BUILDING MATERIAL
9. NOT LABELLED

TABLE 4.5

STABILITY OF VACANCY SUBMARKET STRUCTURES

CHRISTCHURCH 1974

COSINES AMONG COMPONENT AXES *

JANUARY-OCTOBER STRUCTURE

		1.	2.	3.	4.	5.	6.	7.	8.	9.
	1.	-02	06	14	-84	-24	-27	24	02	-26
	2.	-99	02	-02	07	-06	-07	06	00	01
	3.	-01	02	98	16	-06	-02	-09	01	00
JANUARY-	4.	01	98	-03	01	-04	08	-08	03	06
JUNE	5.	-10	-07	08	-35	01	90	00	-13	17
STRUCTURE	6.	03	08	09	07	47	-02	84	-11	20
	7.	-02	-03	01	-07	20	16	01	97	04
	8.	07	00	-05	35	-65	26	46	14	-39
	9.	05	-05	-01	-05	-51	-15	08	07	83

JANUARY-OCTOBER STRUCTURE

		1.	2.	3.	4.	5.	6.	7.	8.	9.
	1.	-53	05	02	17	-19	-20	73	07	-25
	2.	-13	19	19	-40	46	06	-06	-35	-64
	3.	-16	-12	59	-06	-61	23	-16	-38	04
JULY-	4.	71	04	20	-10	-31	-34	19	16	-38
OCTOBER	5.	-37	-05	-24	-20	-29	-59	-52	14	-18
STRUCTURE	6.	03	-96	00	00	18	-09	08	-11	-11
	7.	06	13	17	69	21	-45	-15	-44	01
	8.	-01	05	29	-49	20	-46	23	-13	57
	9.	-16	-03	62	16	27	00	-18	66	-04

JULY-OCTOBER STRUCTURE

		1.	2.	3.	4.	5.	6.	7.	8.	9.
	1.	22	41	17	41	18	00	-50	53	-08
	2.	62	-01	17	-63	41	-07	02	06	05
	3.	-11	02	60	00	-23	00	31	29	61
JANUARY-	4.	-01	11	-10	02	-06	-98	09	05	00
JUNE	5.	-23	12	40	-43	-46	-07	-56	-23	-19
STRUCTURE	6.	30	07	-38	-22	-69	12	11	41	-10
	7.	-11	-33	-40	-12	05	-04	-52	11	63
	8.	62	-07	10	39	-31	-04	-13	-52	22
	9.	07	-82	26	15	-05	-11	-07	29	-34

* LABELS FOR THE COMPONENT AXES ARE GIVEN
IN TABLES

Christchurch's residential sub-areas.

Given that Christchurch's area vacancy submarkets are subject to fluctuation over time, a problem arises in relation to the selection of appropriate submarket structures for inclusion in locational choice models. At least two alternatives exist. The first involves the isolation of vacancy submarket structures for periods which encompassed the duration of search by mover households. The second alternative is one in which the total vacancy submarket structure is entered into the locational choice model. The latter approach is preferred, at least in the initial stages of model-building, since it produces a model framework with a considerably greater level of generality.

A further issue still remains to be considered; in particular whether relative (percentage) or absolute (frequency) data constitutes the appropriate input for vacancy submarket analyses. Percentage data has been employed in all analyses up to the present point with the effect of removing the influence of high turnover areas on the resultant vacancy submarket structure. The use of percentage data should, and in fact did, provide a close approximation to the actual housing submarkets of the city. If absolute frequency data were employed as input for all variables it would almost certainly result in a component structure and score pattern which reflected the dominance of variables and sub-areas with the highest absolute values (i.e. the largest number of listed properties). If, however, the objective of the present section is to identify sub-areas which offer the greatest opportunity for mover households to satisfy certain housing and locational requirements, then the use of absolute data would appear to offer the best prospects for achieving this aim.

To this end, the set of 29 dwelling and site attributes employed previously were subjected to principal axes analysis. The vacancy submarket structures which resulted are presented in Table 4.6. While not departing markedly from the vacancy submarket structure based on percentage data (compare Table 4.2), the vacancy components which do emerge are fewer and account for a larger proportion of the total variation among the variables.

The vacancy submarket which accounts for the largest amount of total variation (35 percent) has been broadly labelled as medium cost housing. It defines what could be termed, Christchurch's 'standard package' single family detached home (refer to the loadings on component 1 for the characteristic set of attributes). Although such homes are widespread throughout the city, areas with high concentrations of this type of vacant property between January and October 1974 were restricted to several locations within Christchurch (see Figure 4.9).

The second vacancy submarket type (20 percent of total variation) identifies areas with available stocks of older, lower priced housing. As might be expected, these areas are concentrated for the most part in the inner city suburbs (Figure 4.10). The range of vacancy submarket types (relating to single family detached dwellings) is completed with the emergence of the third component, good quality, high cost housing (9 percent of total explained variation). Areas which figure

TABLE 4.6

VACANCY MARKET STRUCTURE

CHRISTCHURCH, JAN-OCT 1974 *

VARIABLES	COMPONENTS 1.	2.	3.	4.	5.	H^2
30-39 PERCHES	72					86
BUILT 1960'S	95					91
BUILT 1950'S	73					78
$20-25000	78				51	95
$25-30000	86					88
$30-35000	50			-51		83
BRICK	92					98
4 ROOMS	89					93
5 ROOMS	72					90
3 BEDROOMS	91					98
2 GARAGES	86					93
AVERAGE APPEARANCE	90					97
< 20 PERCHES		55			56	67
BUILT 1920'S		88				86
BUILT PRE 1910		83				79
$15-20000		57				83
WEATHERBOARD		77				95
6 ROOMS		81				91
2 BEDROOMS		56			67	96
4 BEDROOMS		62				81
>$35000			90			90
GOOD APPEARANCE			94			91
$10-15000				85		82
BUILT 1970'S					80	93
BUILT 1940'S					62	87
3 ROOMS					80	95
OWNERSHIP FLAT					80	90
>50 PERCHES						28
CUM. % VARIATION	35	55	64	70	87	
EIGENVALUE	15.8	3.4	2.5	1.3	1.2	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS OVER 50 INCORPORATED IN TABLE
ANALYSIS BASED ON FREQUENCY DATA

COMPONENT LABEL :

1. MEDIUM COST HOUSING
2. OLDER, LOWER PRICED HOUSING
3. GOOD QUALITY, HIGH COST HOUSING
4. NOT LABELLED
5. OWNERSHIP FLATS

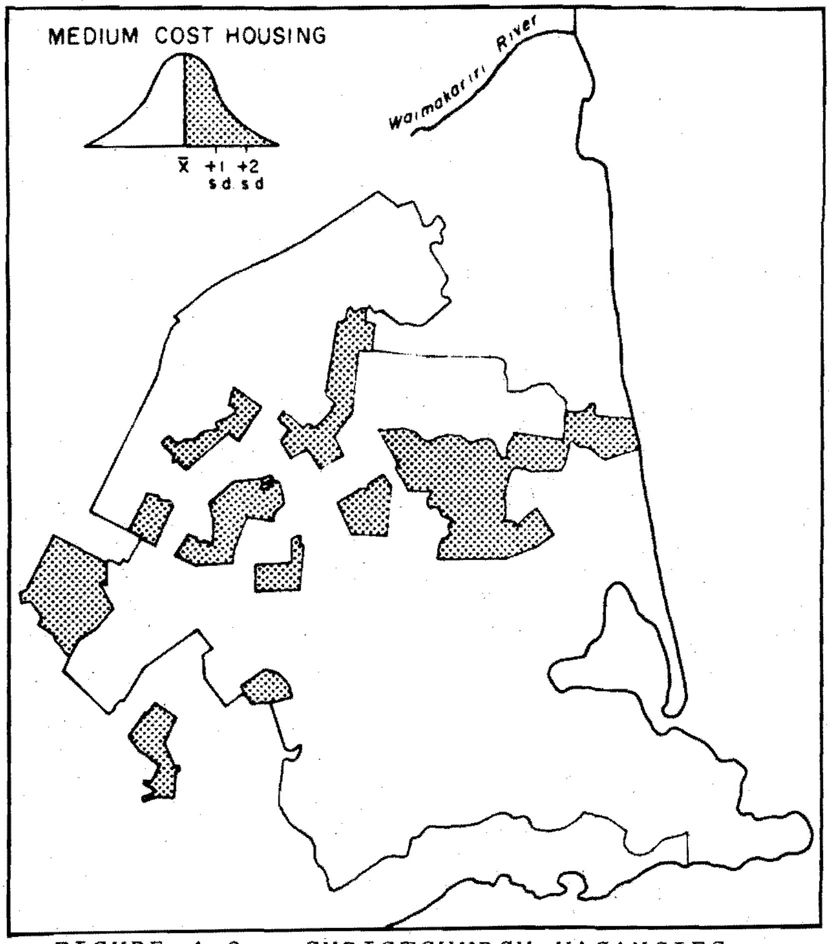


FIGURE 4.9 : CHRISTCHURCH VACANCIES : MEDIUM COST HOUSING

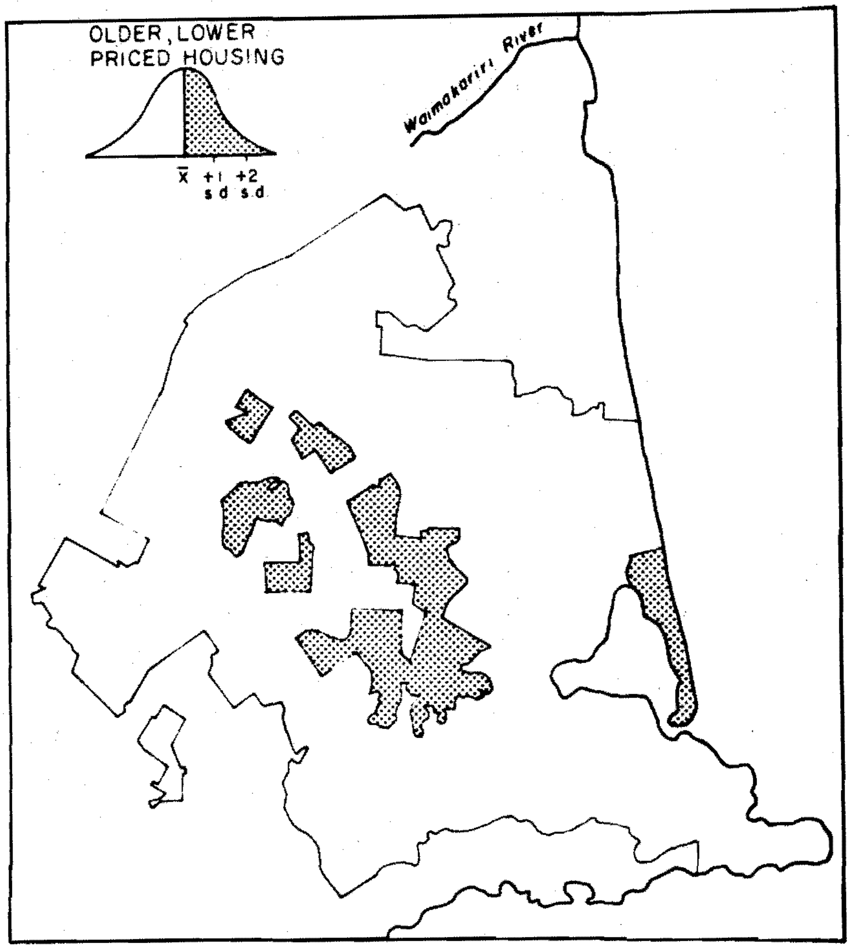


FIGURE 4.10 : CHRISTCHURCH VACANCIES : OLDER, LOWER PRICED HOUSING

prominently on this component of the vacancy market are otulined in Figure 4.11. The remaining submarket type to be labelled represents a distinctive component of the city's housing and vacancy stock, namely ownership flats (17 percent total variation). Areas where such units represent a significant proportion of the entire stock have been referred to previously. Figure 4.12 picks out those areas where there has been a high proportion of ownership units entering the market during the first ten months of 1974.

The vacancy submarket structure based on absolute data and the resultant areal submarkets which have been outlined above form part of the input for a set of locational choice models outlined in Part B. Since there are many sub-areas of the city which, for certain periods in time, either have no vacant properties whatsoever or else have only a narrow range of property types, a measure of property availability should assume an important role in models of locational choice. In these models the vacancy indices enter as dummy predictor variables (a value of unity is assumed if a mover household selects an area which has a high proportion of a particular type of vacancy; otherwise zero), designed to identify the contribution of vacancy constraint in an explanation and prediction of intra-urban locational choice.

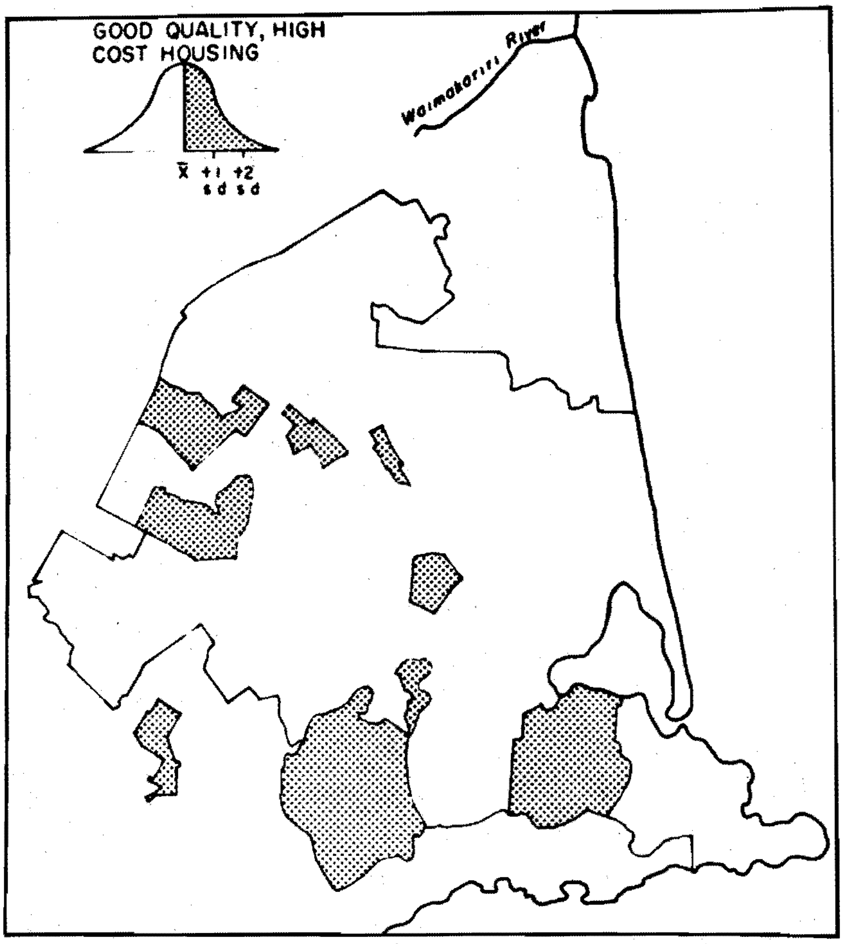


FIGURE 4.11 : CHRISTCHURCH VACANCIES :
GOOD QUALITY, HIGH COST HOUSING

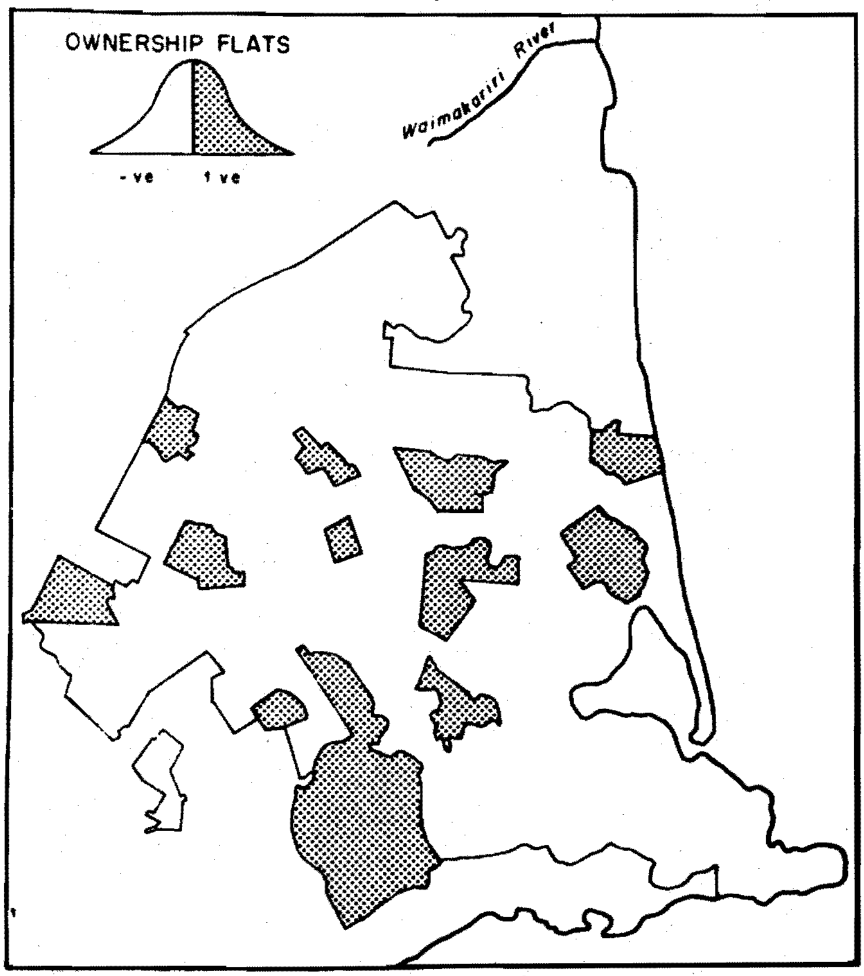


FIGURE 4.12 : CHRISTCHURCH VACANCIES :
OWNERSHIP FLATS

NOTES

1 For ownership property.

2 Namely, the pre-development landowner, the developer and individual households. Related studies by Kaiser (1968), Kenny (1964) and Kaiser and Weiss (1969) also indicate the existence of different types of developers (in particular, the small scale and large scale developers).

3 The Multiple Listing Service exists to provide real estate agents with detailed information on vacant properties.

4 Personal communication with the Director of Christchurch's Multiple Listing Bureau, September, 1974. The figure of 70 percent is higher than in previous years, due in large part to tightness of finance (from both Government and private lending societies) for home purchase during a period of rapid inflation of property values. A greater proportion of properties tend to be listed via MLS in periods when supply exceeds demand (i.e. demand which can be actualised).

5 This period corresponds to the duration in which surveyed households were monitored in connection with any intra-urban migration activity.

6 The census subdivisions of Christchurch in 1974 (see Figure 2.3) provide a satisfactory approximation to most of the city's suburbs - and it is the suburb name which provides the locational tag for most newspaper advertisements.

7 There are also a number of suburbs with little known or little used names, e.g. Aorangi, Edgeware, Ensors, Styx Mill, Kaimahi, Wharenui, Jellie Park, Wairarapa, Masham, Merrin, Deans Bush, Holmwood (see Figure 2.3). It is not surprising, therefore, that such names are little used in newspaper advertisements. In fact 80 percent of areas listed above registered no advertisements for vacant property in the period January-October, 1974.

8 Little more than 50 percent of the variation in the two sources is common.

9 The resulting equation was:

$$Y = 7.7 + 0.11\,X$$

where Y refers to MLS listings, and
X refers to newspaper advertisements.

10 Description of MLS Variables

Variable	Categories*	
	Number	Description
1. Size of section	5	$<$ 20 perches; 20-29; 30-39; 40-49; $\geqslant$50
2. Period of Construction	9	1970's; 1960's; 1950's; 1940's; 1930's; 1920's; 1910's; 1900's and pre-1900 (combined)
3. Market Price	6	\$10-14999; 15-19999; 20-24999; 25-29999; 30-34999; $\geqslant$ 35000
4. Building material (walls)	3	brick; weatherboard; other
5. Building material (roof)	3	tile; iron; other
6. Number of rooms	4	$\leqslant$ 3; 4; 5; $\geqslant$6
7. Number of bedrooms	3	$\leqslant$ 2; 3; $\geqslant$ 4
8. Number of garages	2	1; $\geqslant$2
9. Dwelling type	2	Ownership flat; single family detached.
10. Visual appearance	3	Good, average, poor.

* Data for particular categories of housing variables were employed in relative (i.e. percentage) and absolute form.

11 In locating vacancy submarkets within the city, only those areas with component scores greater than the mean were mapped. This guaranteed a reasonable concentration of the vacancy type in question in the areal unit chosen for analysis. Higher concentrations are afforded by mapping scores at distances greater than one standard deviation above the mean.

12 The method for testing the invariance of component structures was outlined in Chapter 2. Also, see Veldman (1967).

CHAPTER FIVE

URBAN RESIDENTIAL STRUCTURE AND PATTERN IN CHRISTCHURCH: A SUMMARY AND EXTENDED CLASSIFICATION

The preceding analyses suggest several major dimensions along which Christchurch's residential sub-areas may be differentiated. In common with cities of similar size in Western societies, separate socio-economic and life cycle dimensions emerged, together with a factor which identifies tenure status (and, implicitly, life style) variations across the city. Further, these three components were seen to exhibit a high level of invariance when the original data was subjected to variations in the method of analysis.

The latter social-demographic dimension is also indicative of a principal division within the housing market of an urban area - between the rental and ownership sectors. As far as was possible, rental units were excluded from an analysis of Christchurch's housing market (Part B being concerned with the movement of households to ownership property within the city). Three dimensions were found to adequately summarise the variation in Christchurch's housing stock, namely: housing quality, housing value and dwelling type.

While the form of component analysis employed in this study (principal axes with varimax rotation) ensures the emergence of independent (orthogonal) dimensional structures, an inspection of the spatial patterns associated with each dimension suggests a certain degree of covariation among a range of population and housing attributes. This would be in line with the aggregate level studies by Parkes (1972) and Hartshorne (1971), both of whom report a high level of agreement between an area's position in social space and its position in housing space. Clearly, there is an opportunity to present a more general representation of Christchurch's residential structure and pattern.

HIGHER ORDER STRUCTURES

The exact manner by which this multi-dimensional analysis can proceed is dictated in part by the nature of the input. If our interest related solely to the nature of the interaction between social space and housing space, then canonical correlation analysis would have provided a useful statement concerning the relationship between the two sets of component structures (see Openshaw, 1969). However, our interest extends to a third set of components which summarise the level of homogeneity on selected population and housing attributes within Christchurch's residential subareas.

To accommodate all component structures within a single analysis, a higher order factor analysis is undertaken. This procedure, outlined more fully in Nunnally (1967, pp. 366-367), involves the re-factoring of first order components. In the first instance, correlations between the first order components (3 population-based, 3 housing-based, 3 relating to area homogeneity) across all census districts having a complete data set (see Note 6) were obtained. This 9 x 9 matrix was then subjected to components analysis (varimax rotation), resulting in the higher order component structure presented in Table 5.1. The pattern of loadings on the first dimension (life cycle) reflect an alignment of factors which have a similar pattern of spatial variation. The composite areal pattern presented in Figure 5.1 reveals quite clearly the principal variations in the age structures of both population and housing which exist within the urban area: from the outer suburban areas typified by good quality housing and a rather homogenous population (in terms of life cycle and tenure status characteristics) to the inner city residential areas, with their mixture of life cycle groups and a reasonably large component of low quality housing.

The component loadings on the second dimension draw together the factors which relate to between-area and within-area variation in socio-economic status. In Christchurch at least, areas of high social status are also those which exhibit the greatest mixture of status-related population and housing attributes. As Figure 5.2 reveals, most of the urban area could be characterised as low social status - homogenous. The remaining dimension, which accounts for almost one quarter of the total explained variation, is directly concerned with the city's housing stock - in particular, the type and mixture of property. The spatial pattern associated with this dimension (see Figure 5.3) is not as uniform as in the previous cases, a reflection of the nature of the phenomenon with which we are dealing. The rather narrow range in property values within different areas in the city is largely due to the similarity in area land values (which can account for 50 percent or more of

TABLE 5.1

CHRISTCHURCH'S URBAN RESIDENTIAL
STRUCTURE :
HIGHER ORDER COMPONENTS *

VARIABLES	COMPONENTS 1.	2.	3.	H^2
LOW QUALITY HOUSING	79			74
LIFE CYCLE HOMOGENEITY	92			89
TENURE STATUS	72			73
STAGE IN LIFE CYCLE	71			77
MEDIUM-HIGH QUALITY HOUSING		87		78
SOCIAL STATUS HOMOGENEITY		92		90
SOCIO-ECONOMIC STATUS		92		91
DWELLING TYPE			65	47
HOUSING HOMOGENEITY			89	80
CUM. % VARIANCE	30	60	78	
EIGENVALUE	2.6	2.9	1.6	

COMPONENT LABEL :

1. LIFE CYCLE
2. SOCIAL STATUS
3. TYPE OF HOUSING

* VARIMAX-ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS >50 INCORPORATED IN TABLE

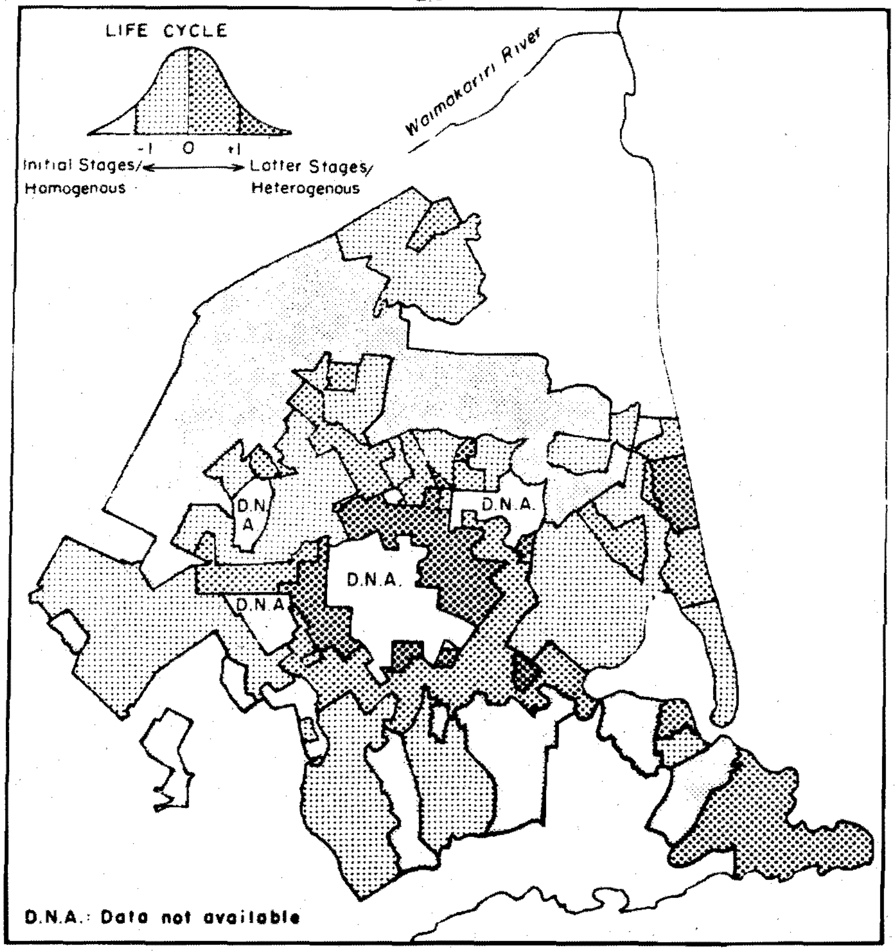


FIGURE 5.1 : HIGHER ORDER PATTERNS : LIFE CYCLE

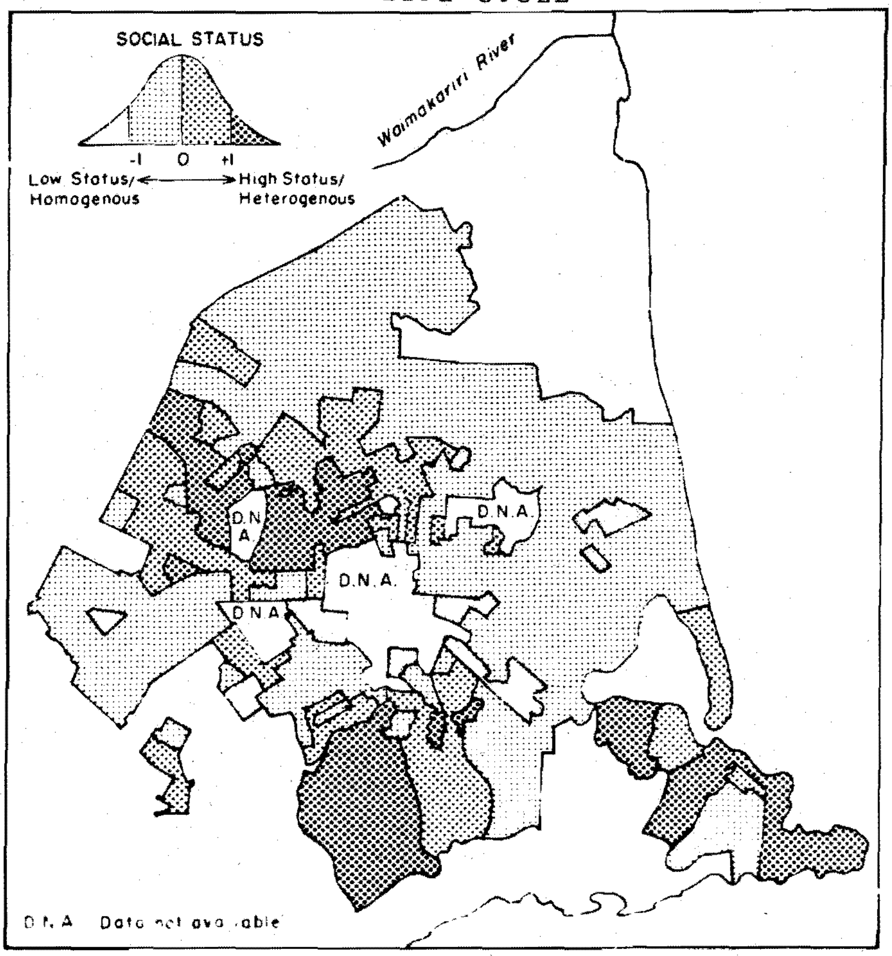


FIGURE 5.2 : HIGHER ORDER PATTERNS : SOCIAL STATUS

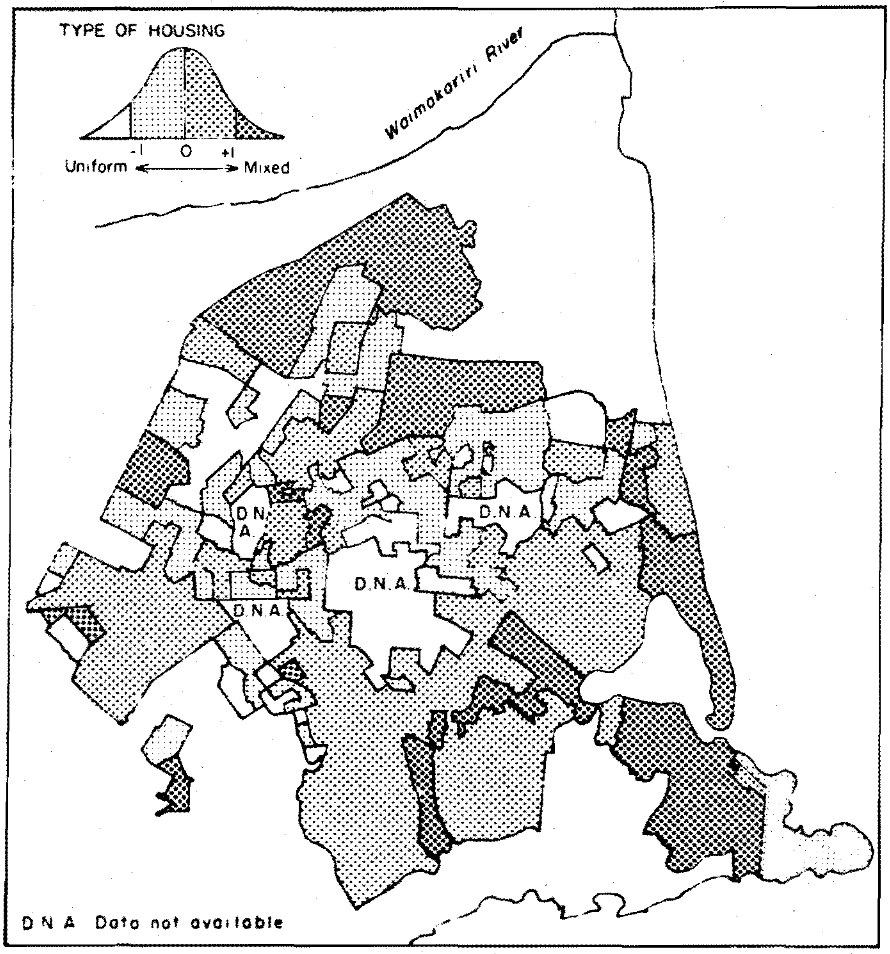


FIGURE 5.3 : HIGHER ORDER PATTERNS : TYPE OF HOUSING

property value). Certain residential areas are ascribed a higher value than others by the upper status group in the community. Adjoining areas are normally assigned a somewhat lower value - and so the process continues. The association between area property value and area socio-economic status (component 1) follows from the concentration of particular socio-economic groups in different areas of the city.

Housing quality varies as a function of the period of construction; and Christchurch's built up area has been seen to expand in a uniformly circular fashion. Given this tendency, and the fact that different life cycle groups have little option but to follow the central city - suburban/rental-ownership division of the housing market, accounts for the alignment of the first order factors displayed in component 2. The remaining housing characteristics relate mainly to dwelling type, building materials and dwelling size - attributes which are less efficient (than those previously considered) in differentiating one residential area of the city from another. There are large sections of the city which have a similar type of housing (three bedroom, detached, concrete block). Greater mixture is evidenced in the higher status areas and areas which have a core of houses constructed in an earlier period (e.g. Sumner, Brighton, Belfast, Hornby, Papanui).

While the higher order factor analysis has collapsed several important dimensions of urban differentiation into a more general set of residential descriptors, it still remains that the areal classifications introduced thus far are only partial representations of Christchurch's urban residential pattern. The life cycle-tenure status-life style pattern has been discussed, for the most part, in isolation from the social status pattern and the housing pattern. The following section attempts a more comprehensive classification of Christchurch's residential subareas.

CLASSIFICATION OF CHRISTCHURCH'S RESIDENTIAL SUBAREAS

Given the number of papers currently in existence inside and outside the geographic field which outline and comment upon classification methods[1], a further blanket summary has little to recommend it. Instead, the method chosen for the ensuing classifications, namely the agglomerative hierarchical polythetic procedure, is introduced, and reasons for its adoption are outlined.

1) Agglomerative vs. Divisive Approach

Agglomerative techniques are concerned with building up group structures by combining pairs of individuals (census districts in the present case) or subsets to form larger groupings. Divisive methods approach the classification problem from the other end and attempt to partition an initial population into a set of meaningful groups. The link between agglomerative and divisive approaches and inductive and deductive research strategies is shown to be more apparent than real by Barker (1974, p.9), and it remains that the choice of an agglomerative procedure in classification studies derives largely from its inherent economies in calculation (McNaughton-Smith, 1965, p.4).

2) Hierarchical vs. Non-Hierarchical Approach

Both approaches, of necessity, employ some form of similarity measure (e.g. correlation, euclidean distance) between all individuals to be grouped.

In a hierarchical analysis the similarity matrix is searched and the two most similar individuals are selected and merged together as a synthetic unit. It is then common in most hierarchic methods for the re-computation of further similarity matrices[2], grouping then continuing, in stepwise fashion, until all of the individuals are classed into one group.

Non-hierarchical methods involve a decision on the number of final groups prior to the commencement of analysis. Allocation of individuals to groups then proceeds on the basis of the distance (i.e. similarity) between individuals and cluster centre parameters (with provision for a re-allocation of some or all of the individuals among clusters when the main allocation process is complete). The decision not to employ a non-hierarchic strategy in the present set of classifications reflects the absence of any basis for an a priori specification of group numbers, although the 'magical number seven plus or minus two' appears to accommodate the results of several urban typologies (Parkes, 1973: 9 Groups; Badcock, 1973: 8; Poulsen, 1974 : 5).

3) Monothetic vs. Polythetic Approach

The distinction here is in terms of the number of variables used at each stage of the classification. In a monothetic procedure each division is based on one variable whereas in a polythetic procedure, it is based on several (Spence and Taylor, 1970). The former strategy is criticised by Sokal and Sneath (1963, pp. 13-14) for the certain misclassification afforded an individual which is identical with its natural 'cogeners' in every attribute other than the one upon which the primary division was made.

A polythetic arrangement, on the other hand, places together individuals that have the greatest number of shared attributes. No single variable is either essential to group membership or is sufficient to make an individual a member of the group. It is for this reason, together with the fact that no rationale exists for singling out one variable for primary division, that the polythetic strategy is adopted.

Grouping and Regionalising

The form of classification discussed above, when applied within a geographic context (i.e. areas become the individuals or O.T.U.'s) generates what has been termed uniform spaces[3] (Johnston, 1970). These are a set of relatively homogenous areal units (on specified criteria) which are not necessarily contiguous. They have an implicit connection with geographic location, since the individual areas are spatial units for which measurements are obtained. But they do not qualify as regions. There is general agreement (Hagood, 1943; Berry, 1968; Johnston, 1970; Grigg, 1965; Taylor, 1969) that a region must comprise a set of areas, characterised by relative uniformity of their properties and which are contiguous[4]. Berry (1968) also draws attention to the fact that even with a contiguity constraing operating, it is possible to obtain attenuated regions whose extremes may be a relatively long distance apart. It is possible that, for some purposes, a compactness constraint may be required in regionalisation.

Within-city regionalisation is achieved in the present study via three stages (after Czyz, 1968 and Johnston, 1970):

1) principal components analysis of the original variable set. This step is undertaken to reduce a large number of classificatory variables to a smaller and more general set of <u>classificatory dimensions</u>; and to provide orthogonal components for input into classification (a requisite when euclidean distance measures of similarity are employed),

2) multidimensional typology, based on dimensional similarity analysis, with a view to establishing the major <u>types</u> of areal unit within an urban area,

3) regional classification, where <u>regions</u> are derived from the number of spatially continuous groupings of areal units within a definite type.

Spence and Taylor (1970, pp. 49-50) have criticised this procedure (stages 2 and 3) when

> *... contiguous groups are required for the purpose of the overall research project.*

However, for the purposes of the present study this criticism does not apply. Without reiterating too much of what was outlined in Chapter 1 and pre-empting what is contained in Chapter 7, attention needs to be drawn to the nature of the locational choice models established in Part B. Briefly, the importance of location in locational choice models (as formulated in the present study) can be properly assessed only if separate allocation models are established for movement to <u>area types</u> (What Rees, 1970, p.313, terms community types), and to <u>sub-urban</u> regions; AND where a 'final' typology, rather than an initial similarity matrix with contiguity constraint operating, forms the basis for subsequent regionalisation.

This follows directly from Spence and Taylor's (1970, p.49) argument that the results of regionalisation based on a typology (following Czyz, 1968) would be different (in terms of number of regions and area membership) from a regionalisation based on a grouping procedure which incorporates a contiguity constraint.

In the present study, therefore, regionalisation is undertaken from a typology by inspecting the spatial distribution of area types for the presence of any spatial discontinuities.

Christchurch Typologies

The component analyses undertaken on the population and housing bases (Chapters 2 and 3) provide a number of dimensional inputs into the classification analyses[5].

1) Typology Based on Social-Demographic Characteristics of Residents

The three dimensions of Christchurch's social and demographic structure (tenure status - life style, stage in life cycle and socio-economic status), which together accounted for approximately 80 percent of the variability in the original 14 variables, comprise the input for the first typology. The result is a hierarchical set of groupings represented as a dendrogram and shown in Figure 5.4[6]. The problem is then one of deciding which stage of the grouping procedure provides the most useful classification. A common approach to the problem is to measure the amount of information lost at each step in the grouping process (Barker, 1974). Information is lost during the procedure by representing individual areas by their group centre co-ordinates rather than by their own (individual) co-ordinates[7]. One indication of the extent to which information loss occurs is to measure the total distance between each individual and its group centre

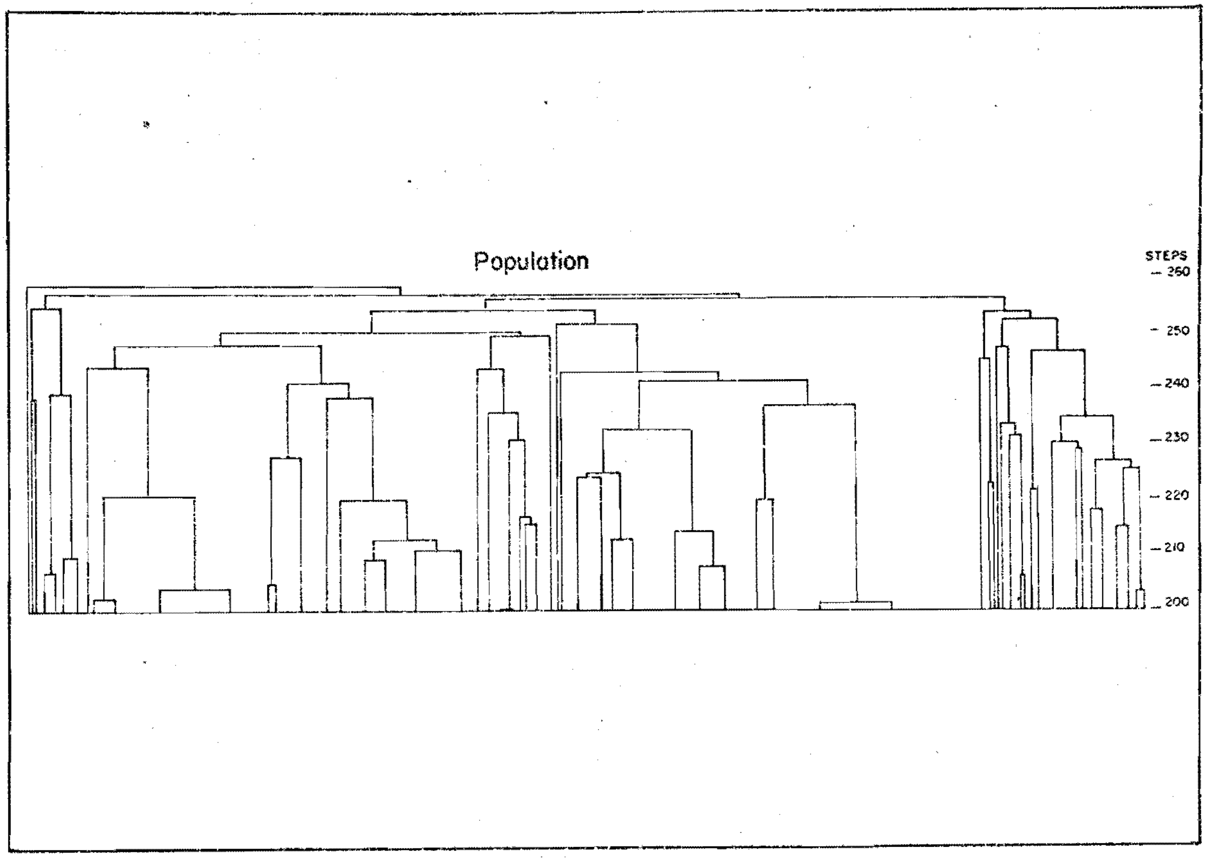


FIGURE 5.4 DENDROGRAM ASSOCIATED WITH TYPOLOGY OF CHRISTCHURCH C.D.'s BASED ON POPULATION FACTORS

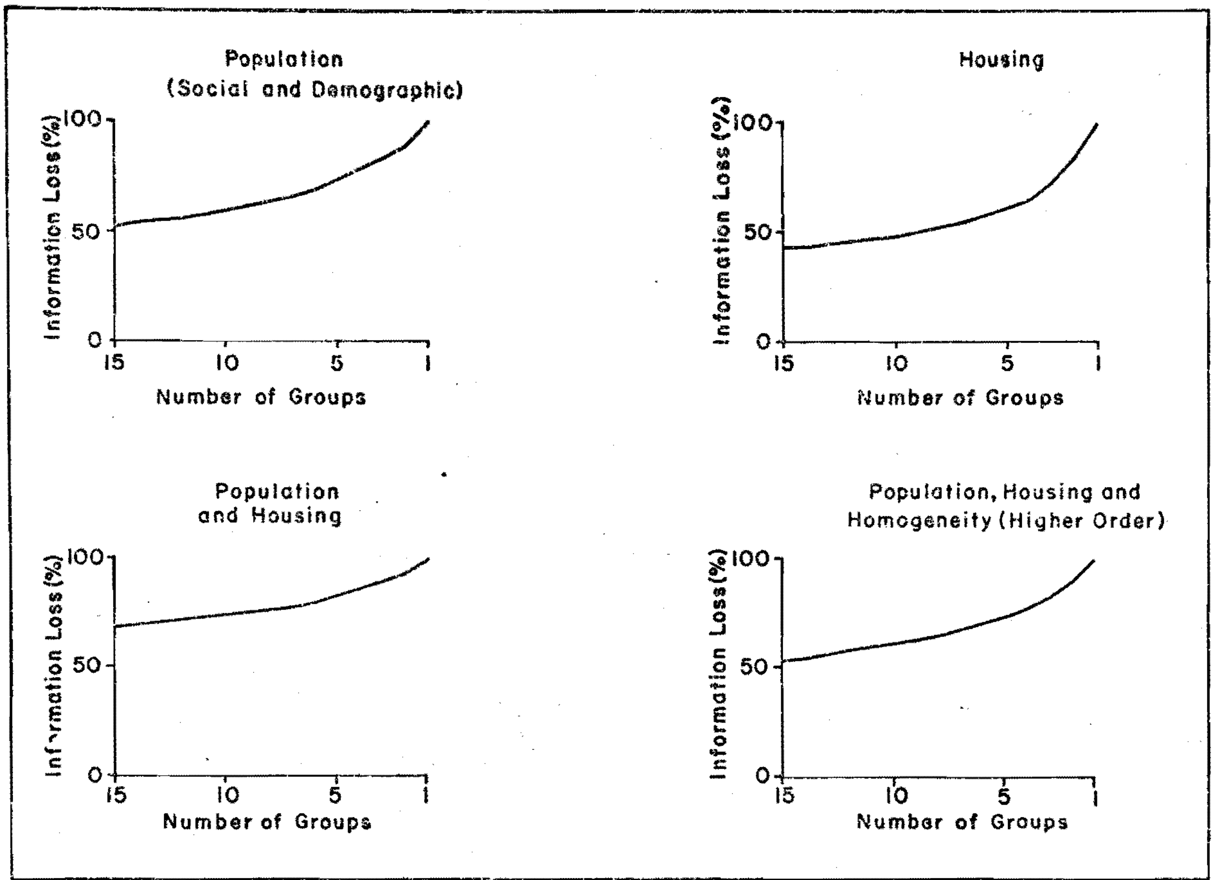


FIGURE 5.5 : PROFILES OF INFORMATION LOSS FOR URBAN TYPOLOGIES

(referred to as the within group distance) and express this measure cumulatively as a measure of the total distance between all individuals. As the number of group centres become fewer this measure will increase. When this measure is plotted against the decreasing number of groups, kinks in the profile are sought which can be interpreted as a 'significant' decrease in the amount of information conveyed by that number of groups. The profiles of information loss (Figure 5.5) illustrate the difficulty in deciding what constitutes a break of slope, and thus the 'best' grouping. There is no marked break in slope, except in the last one or two steps - and the adoption of a two or three group classification is, perhaps, an over simplification of Christchurch's residential pattern. Readily discernable changes in slope are apparent, however, and it is in the vicinity of the 5-10 group stage that such change occurs for the four typologies - the exact position being a matter for some subjective judgment.

An 8-group population (social-demographic) typology was chosen for mapping, the spatial patterning of the area types being represented in Figure 5.6. Three types appear to strongly reflect variations in socio-economic status: the prestige 'hearth' of Christchurch, Fendalton (III) emerges as a separate grouping from the remaining set of high status areas to the north west of the centre and along sections of the Port Hills (I). The low social status grouping (V) is one which clearly identifies the location of state rental housing within the city. Another three types principally reflect life cycle and life style variations:

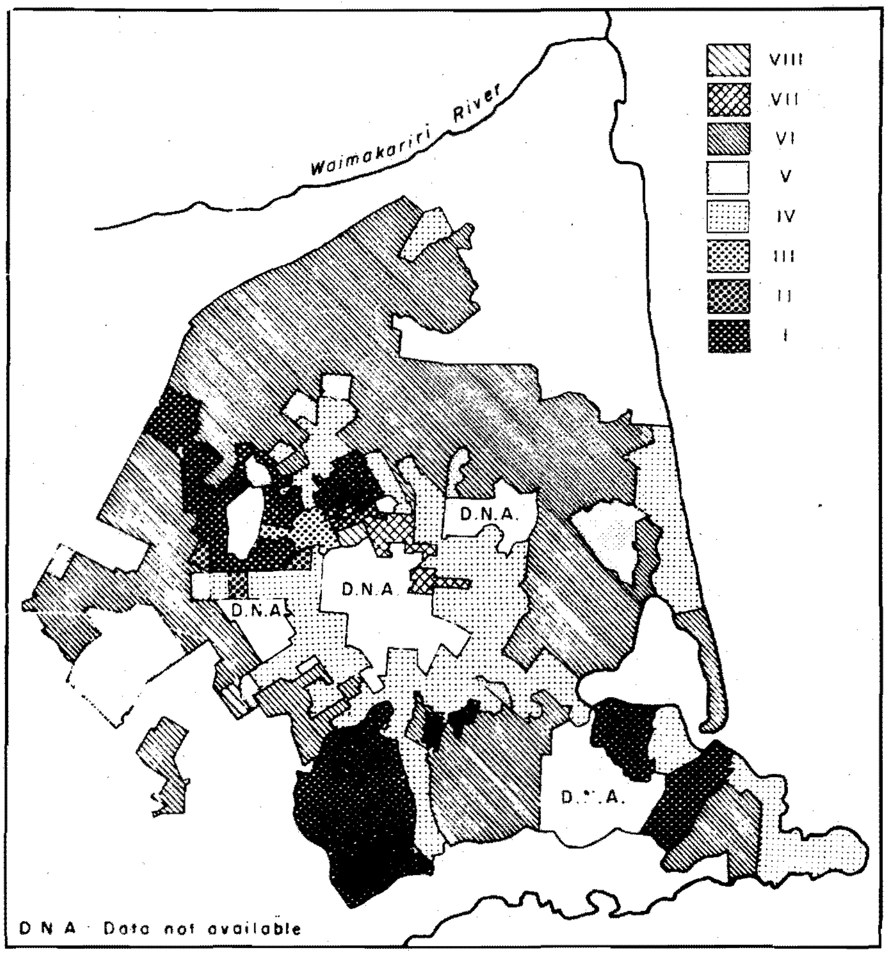


FIGURE 5.6 : CHRISTCHURCH : POPULATION TYPES

the inner city, low family status, rental areas (VIII); the suburban high family status areas with high levels of homeownership - the most extensive of all area types (VI); and a zone of areas which exhibit a certain degree of mixture with regard to the life cycle stage and tenure status of their residents. The remaining two groups (which together involve 7 census districts) are not labelled, their separate existence being due largely to the presence of large institutional populations within the sub-areas concerned.

The area types identified above provide a basis for generating a residential allocation model which operates under the hypothesis that households choose or are forced to live among households with similar social and demographic characteristics to their own (see Chapter 7).

2) <u>Typology Based on Housing Characteristics of Sub-Areas</u>

Our primary concern with ownership housing led to the exclusion of two components related to Christchurch's urban land and housing market ('vacant urban land' and 'state housing'), the present housing typology being based, therefore, on dimensions relating to housing value ('medium and high value housing') housing quality ('low quality housing') and dwelling type.

A 10-group solution was chosen as a suitable level for representing the city's distinctive housing spaces (see Figures 5.5 and 5.7). The 'dominant' area type (Figure 5.8) is one which is characterised by medium quality and medium value housing, with some mixture of dwelling types, but in the main comprised largely of single family detached dwellings (V). It is this 'type' of housing which greatly

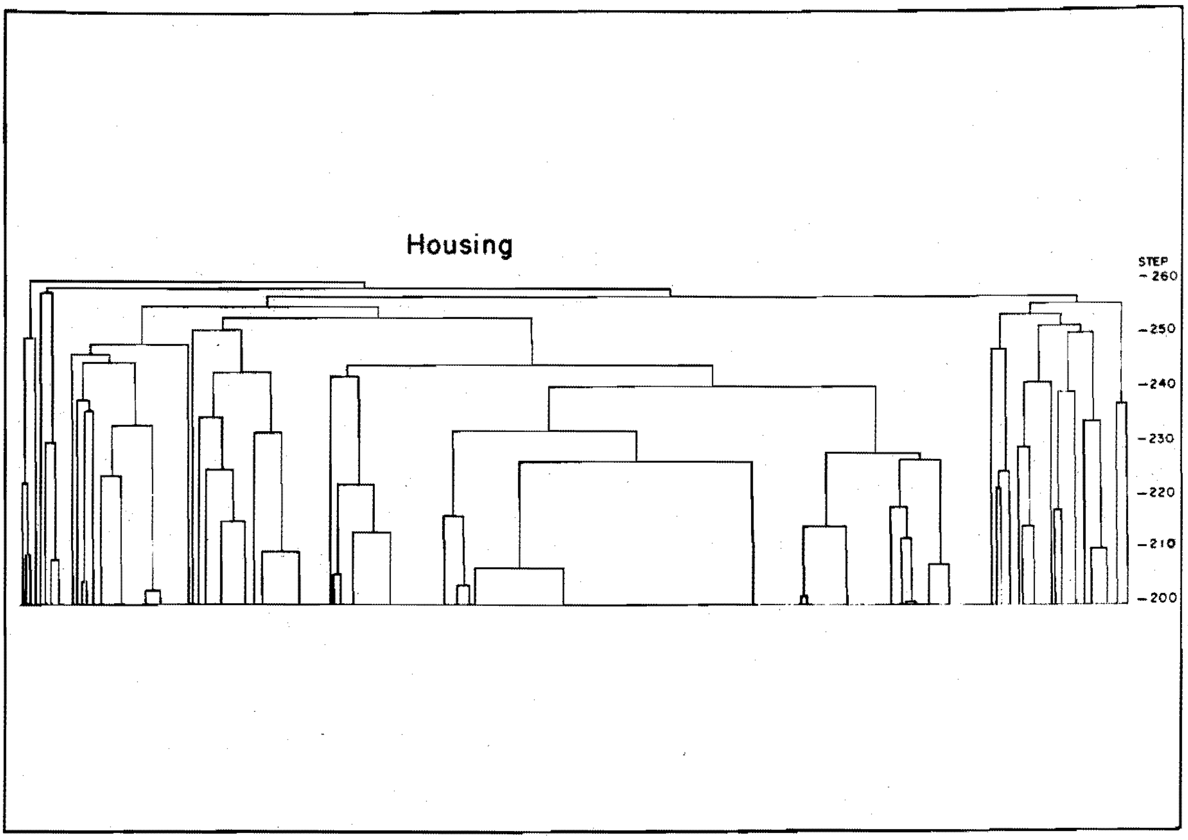


FIGURE 5.7 : DENDOGRAM ASSOCIATED WITH TYPOLOGY OF CHRISTCHURCH C.D.'s BASED ON HOUSING FACTORS

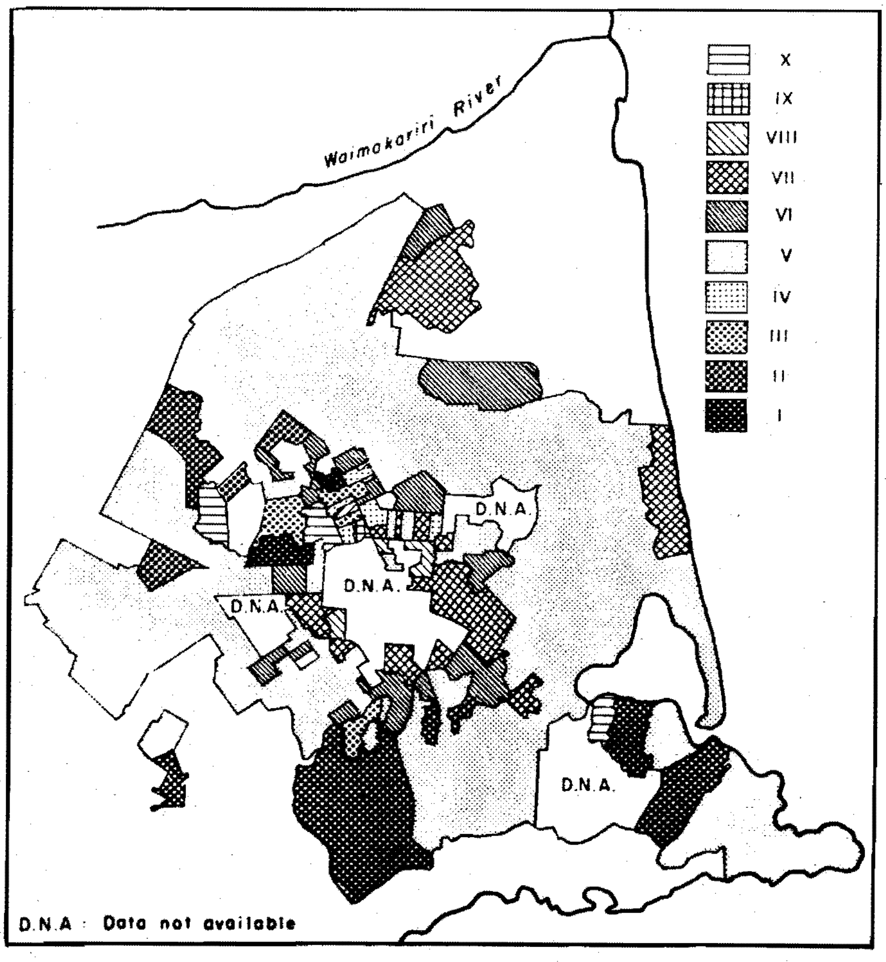


FIGURE 5.8 : CHRISTCHURCH : HOUSING TYPES

contributes to the uniformity of appearance of Christchurch's suburban areas - a result, in part, of the city's topography which does not encourage a wide range of housing designs.

Greater housing variety is experienced in the hill suburbs and in the higher status areas (II, III, X); and in a number of inner suburbs which are now experiencing renewal (IV, VIII). The remaining area types include those characterised by medium value, lower quality single family housing (VII), which, in a number of cases are adjoined by areas with somewhat higher quality (and value) properties (VI). An area which retains its uniqueness in the typology is Merivale (IX), a high status, inner city suburb, which contains examples of prestige homes built over the last 80-100 years. Property values remain high throughout the area, but there is considerable variation in dwelling types, building materials and housing quality.

These area housing types, like their social-demographic counterparts, provide a basis for establishing residential allocation models which are formulated under the premise that mover households select areas which contain housing with the necessary attributes to satisfy their residential needs.

3) <u>Typology Based on Population and Housing Characteristics of Sub-Areas</u>

An extended typology based on dimensions of social and physical space[8] provides an opportunity for increasing the generality of an allocation model established on the basis of the resultant area types.

Seven area types were chosen to summarise the dominant population and housing patterns in Christchurch's residential areas (see Figures 5.5 and 5.9). Three area types dominate. The outer suburban type (V) comprises areas with a high proportion of households in the early and middle stages of the family life cycle, in ownership property of average to good quality and medium value (Figure 5.10).
Socio-economic status level is generally middle-order. The second major area type (IV) includes those areas developed during an earlier period of city growth. As a consequence, there is a greater mixture of dwelling types and housing quality. Slightly lower levels of socio-economic status are characteristic of residents in these area types, and there is a reasonable degree of variation in the life cycle characteristics of the population (resulting from a core of stable residents who have aged with their area; and younger, more recent arrivals). Variation in life cycle stage is also evident in the high status area-type grouping II. The housing is good quality and of high value and the occupants are, for the most part, high income earners. Area-type VII is given over almost completely to rental accommodation, the occupants being mostly young (and either unmarried or in the pre-child stage of the family life cycle) and on moderate to low incomes. The remaining area-types are both characterised by high value property; but whereas III has a considerable proportion of rental properties and a variety of housing types, area-type I is characterised by older single family owner-occupied dwellings of average physical quality.
The age structure also tends towards the latter stages of the life cycle to a greater degree for residents in the latter area-type.

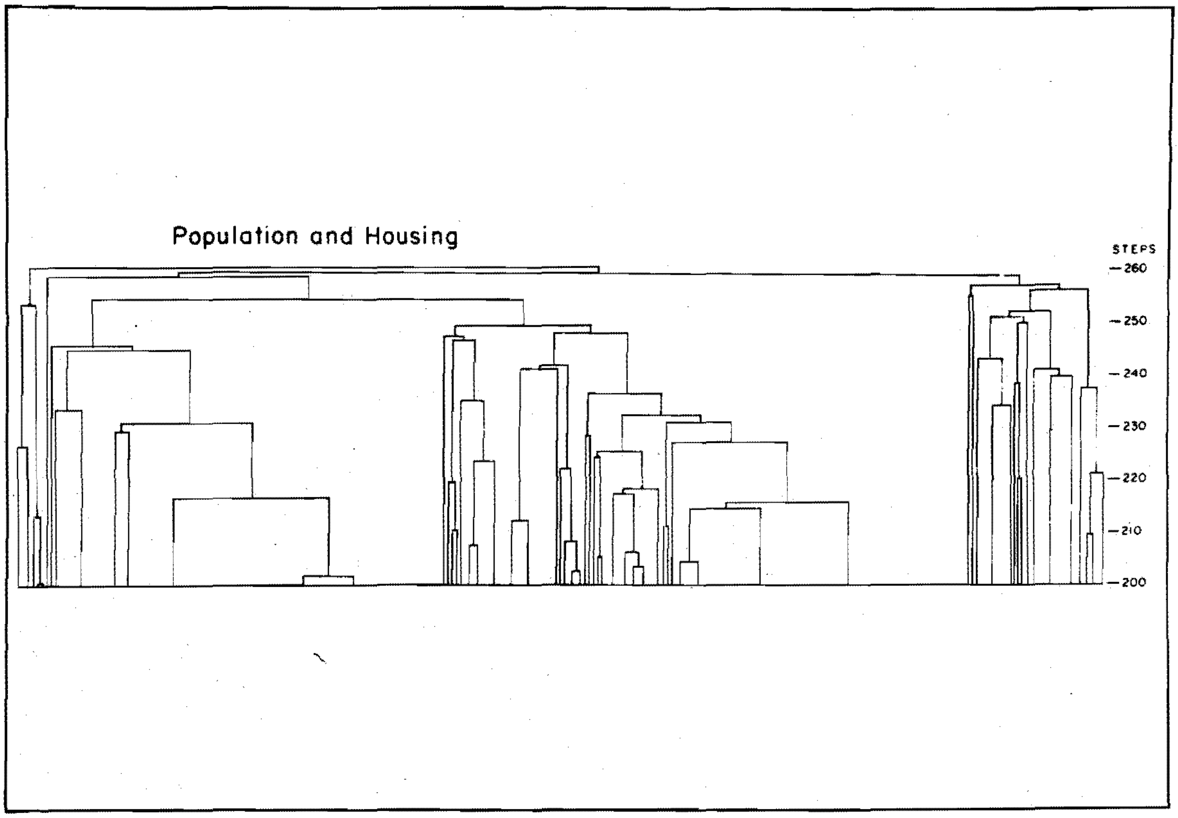


FIGURE 5.9 : DENDROGRAM ASSOCIATED WITH TYPOLOGY OF CHRISTCHURCH C.D.'s BASED ON POPULATION AND HOUSING FACTORS

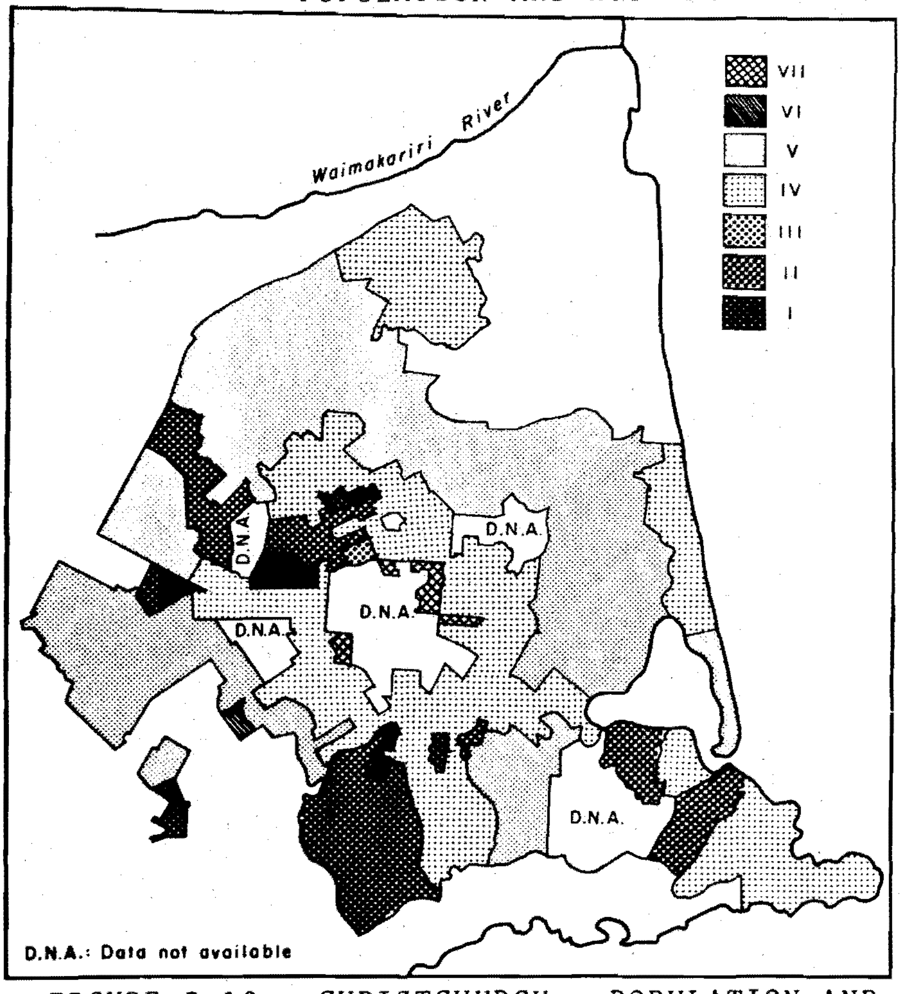


FIGURE 5.10 : CHRISTCHURCH : POPULATION AND HOUSING TYPES

4) Typology Based on Population, Housing and Homogeneity Characteristics of Sub-Areas

The level of heterogeneity in the population and housing characteristics of Christchurch's residential sub-areas was examined in Chapter 3 with a view to providing a means for assessing its influence on the explanatory and predictive efficiency of locational choice models. An earlier section in the present chapter undertook a higher order factor analysis on selected population, housing and homogeneity components, producing three dimensions relating to life cycle, social status and housing characteristics of the city's residential structure. These dimensions provide the basis for the dendrogram presented in Figure 5.11 and the pattern of higher order area-types mapped in Figure 5.12.

Many of the comments directed at the previous three typologies are again relevant. Rather than repeat these, brief mention is made of those areas in which there has been some change. The major variation occurs with a split in the outer suburban area - type. No longer does this type give the impression of a uniform 180 degree arc. Instead it breaks into two major area-types: type V representing a relatively homogenous space, while type VII reflects an increased mixture of population and housing attributes. Area-types II and III are distinct from all others primarily because of the high level of heterogeneity in the housing which characterises the areas in question. The other major types which remain include VI and IX, the former space being one with high levels of mixture on life cycle attributes; the latter evidencing considerable mixture in social status attributes. Because of such internal variation within these

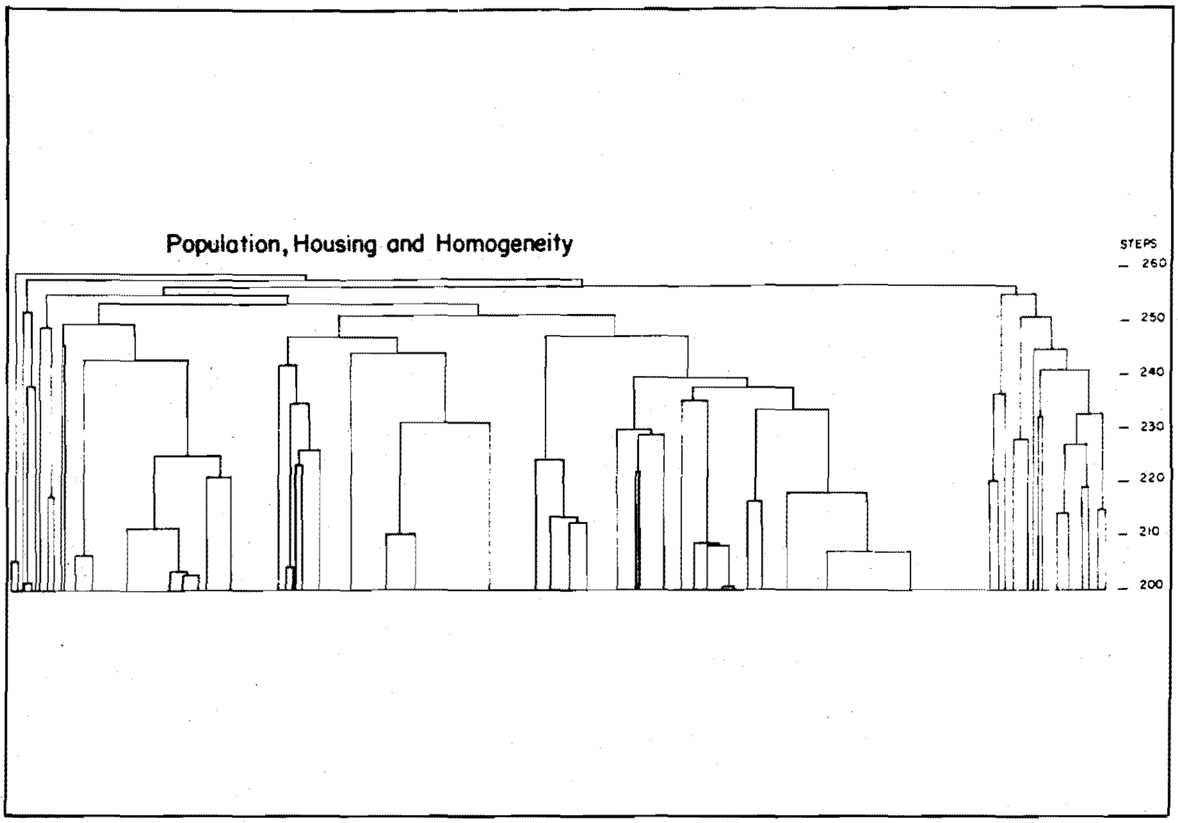


FIGURE 5.11 : DENDROGRAM ASSOCIATED WITH TYPOLOGY OF CHRISTCHURCH C.D.'s BASED ON POPULATION, HOUSING AND HOMOGENEITY FACTORS

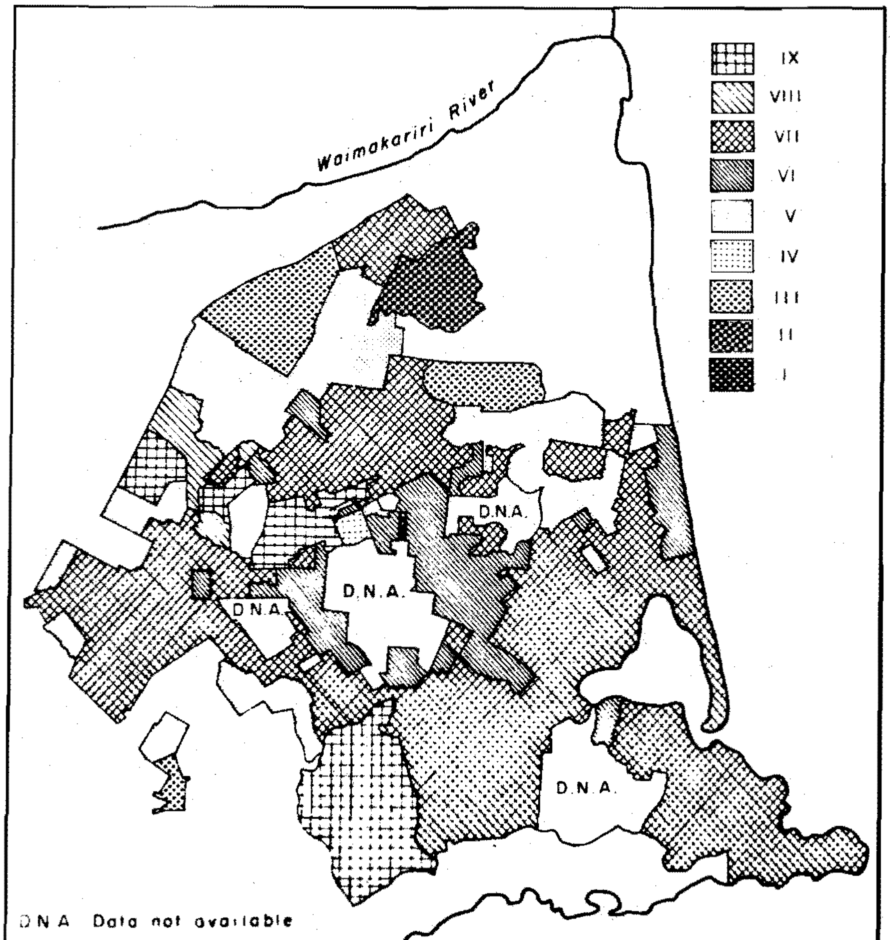


FIGURE 5.12 : CHRISTCHURCH : HIGHER ORDER AREA TYPES

area-types, it will be important to compare the performance of allocation models based on classifications or regionalisations where attempts have been made to build in an adjustment for area heterogeneity.

Christchurch's Sub-Urban Regions

Locational choice models based on the typologies introduced in the previous section are essentially aspatial[9]. They are formulated on the premise that a household will move to a particular area-type (differentiated by aggregate population and housing attributes) on the basis of certain household characteristics (household structure, residential needs, etc.).

But a cursory inspection of the spatial pattern associated with the population and housing typologies reveals that not only do some area types extend in a continuous band over considerable territory (particularly the outer suburban type), but in many cases, a particular area-type occupies several separate locations within the city. The locational choice models based on the typologies are not, in fact, locational models. Allocation is to area-types or uniform spaces. The models are concerned with establishing the extent to which 'certain types of households choose, or are forced to live in certain types of area'.

If we were to stop at this stage in our residential modelling, however, we would be discounting the role of location in household relocation behaviour. The reality of our urban areas, where different land uses (and residential areas) are spatially separated[10], suggests that access may be an important constraint on residential location. Residences are separated from workplaces as well as from a range of other activity nodes - parents, friends, shops, schools, recreation facilities and so on. Within such a differentiated urban framework, travel becomes the only means of correcting the spatial imbalance. An example of a typical set of linkage patterns formed among urban activities by the travel of individuals in their daily, weekly or seasonal use of urban areas is presented in Figure 5.13. This activity network defines what has come to be known as a household's activity space (Horton and Reynolds, 1969, 1970; Brown, Horton and Wittick, 1970), and it is possible that choice of residential location is influenced by the desired form of the activity space. In other words, a particular location may be chosen because it preserves the important elements in a household's existing activity network and facilitates its extension to other important activity nodes.

The question is now one of how best to group the residential sub-areas of Christchurch in a manner which will reflect their locational attribute. A classification of residential areas in terms of their location with repsect to the city centre, their relative accessibility within the city as a whole, and the work travel mode of sub-area residents was undertaken (see Appendix V.1), but was not incorporated in within-city classification due to its limited spatial framework (i.e. absence of origin-destination journey to work data) and its limited

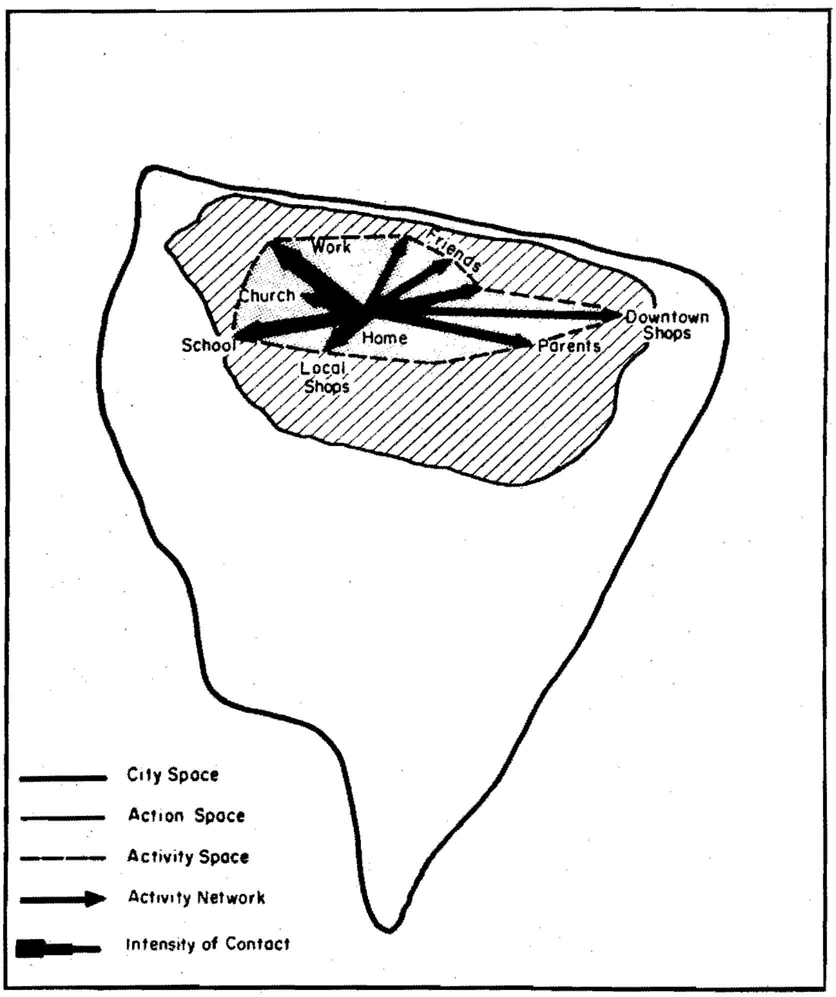


FIGURE 5.13 : IDEALISED HOUSEHOLD ACTIVITY SPACE

representation of access and activity variables (particularly non-work activities).

Instead, the area-types which emerged from the typologies of population, housing and homogeneity attributes (and which are represented in Figures 5.6, 5.8, 5.10, 5.12) are inspected for the presence of spatial clustering. Contiguous sub-areas within a particular area-type are designated as separate sub-urban regions. Figure 5.14, for example, depicts the regionalisation undertaken on the population and housing types (Figure 5.10). One obvious result of the regionalisation is an increase in the number of area units: seven area-types generate 25 sub-urban regions (the distribution of higher order regions is depicted in Figure 5.15). These regions, in a similar manner to the 'types' act as potential destination areas for the sample of 135 mover households who relocated within Christchurch during 1974.

In the section of the thesis which follows (in particular, Chapter 7), the analyses reported in Chapters 2-5 provide the basis for modelling household locational choice within the framework outlined in the INTRODUCTION. The nature of the Christchurch mobility survey, which provides the necessary data for setting up and testing empirical mobility models, is discussed in Chapter 6. This chapter also establishes explanatory models of household residential mobility and residence choice behaviour.

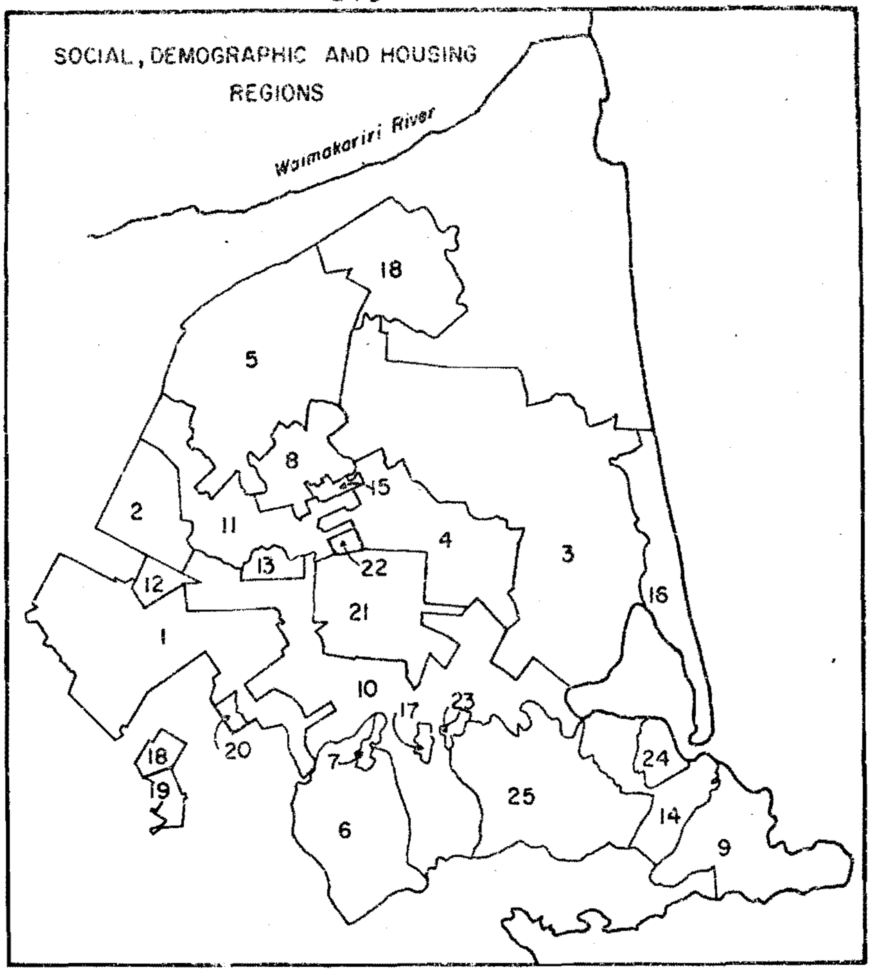


FIGURE 5.14 : CHRISTCHURCH : POPULATION AND HOUSING REGIONS

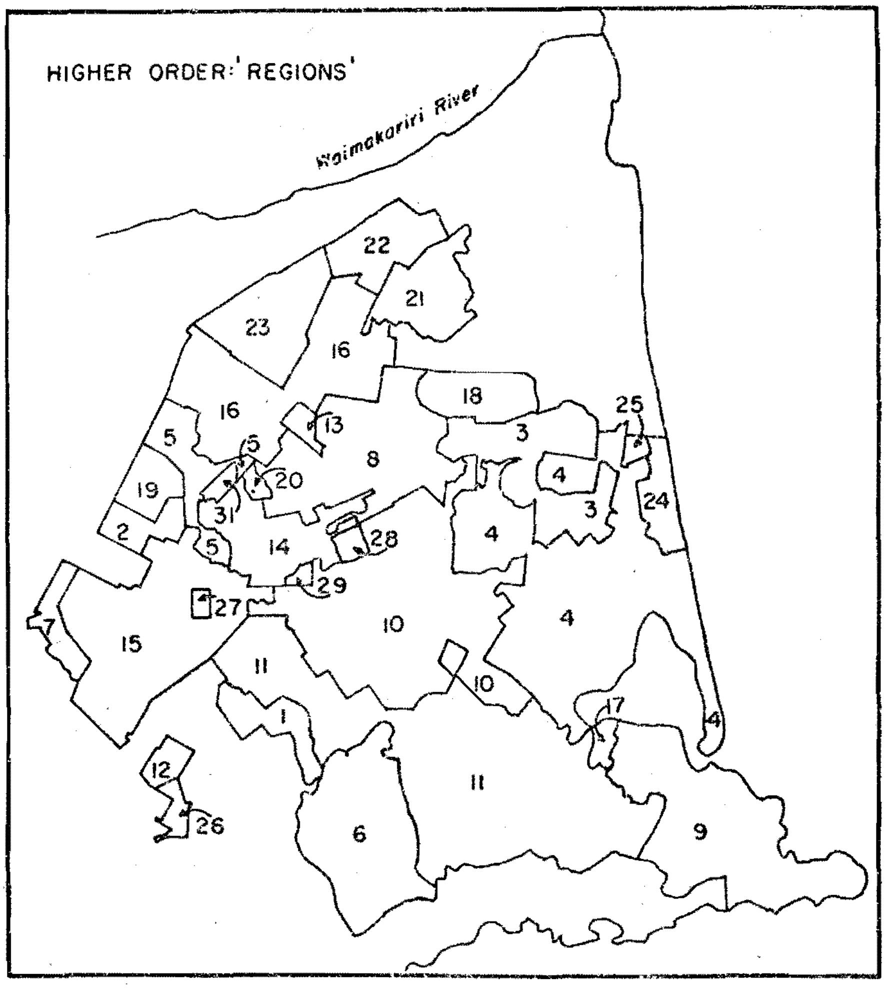


FIGURE 5.15 : CHRISTCHURCH : HIGHER ORDER REGIONS

NOTES

1 Useful review papers include: Mather (1972), Spence and Taylor (1970), Barker (1974), Johnston (1968, 1970), McNaughton-Smith (1965), Rees (1972), Berry and Wrobel (1968) and Sneath and Sokal (1973). Recent urban geographic applications are found in Parkes (1973), Badcock (1973).

2 There are solutions, such as Sneath's 'single linkage method' (Sokal and Sneath, 1963), which require no recomputation of the similarity matrix in arriving at a hierarchical solution.

3 A number of the more important uniform spaces in urban studies are <u>social space</u>, <u>housing space</u>, and <u>community space</u> (see Rees, 1970).

4 'Contiguity constraint' has now been built into several classificatory routines (e.g. Openshaw, 1974; Tobler, 1970).

5 The geographical grouping program CNGRP (Tobler, 1970, pp. 133-147) is employed in the classifications which follow. Also, see Barker (1974 , pp. 20-34) for a detailed description of the attributes of CNGRP. The terms classification and typology are used interchangeably.

6 The number of census districts included in the classificatory analyses is 261 - the number of sub-areas for which a complete data set (population and housing) is available.

7 At each step in the classification the 'groups' are becoming less homogenous than in the orginal space of 261 sub-areas.

8 The interaction of social and physical (housing) space has been the focus of several empirical and theoretical studies (see Feldman and Tilly, 1960; Openshaw, 1969; Yeates, 1972; Rees, 1970).

9 Although it could be argued that since the data relates to areal units, the spatial component is already built in.

10 The reasons for the segregation of different forms of landuse are mostly economic, involving such factors as site costs and transport or access costs (see Richardson, 1971 and Goodall, 1972 for a review). Town and Country Planning legislation and Zoning ordinances also reinforce separation of land uses, as well as spatial segregation within particular land use types (e.g. variation in densities and dwelling types by area).

PART B

MODELLING RESIDENTIAL MOBILITY OUTCOMES

CHAPTER SIX

RESIDENTIAL MOBILITY AND RESIDENCE CHOICE MODELS

Residential mobility research is presently at the stage where various model - frameworks are being employed in an attempt to identify the essential elements of this complex urban process. In the INTRODUCTION, it was argued that the residential mobility process is best conceived in terms of three principal outcomes: the decision to stay or move, residence choice, and locational choice - representing as they do a logical progression of states within the overall relocation process. Accepting that this is a satisfactory approach to adopt, a problem still remains in deciding upon a consistent methodology for examining each outcome. The literature suggests a number of model frameworks which are potentially applicable to the general area of intra-urban residential movement (for a detailed outline of the alternatives see Harvey, 1969; Sweet, 1972; Martin and March, 1972). The most detailed specifications of the residential mobility process have been outlined via <u>conceptual</u> models (e.g. Smith, 1965; Brown and Moore, 1970; Butler et. al. 1969; Kaiser and Weiss, 1969; Moore, 1973) in which the major variables thought to be involved in the process are outlined and the connecting links specified, albeit in many cases, diagrammatically.

From this stage the progression has tended to be towards the <u>statistical model</u>, whereupon a number of the relations hypothesised in the explorative schemas are formalised and subjected to empirical examination. In this context the linear model appears, in the first instance at least, to be a suitable vehicle for examining the factors which give rise to particular mobility outcomes. The appropriateness of the linear model rests with the fact that a dependent variable can be readily isolated and measured for each mobility outcome, and on the assumption that the predictor variables chosen for inclusion in the model equation provide an independent and additive contribution to a specification of the mobility outcome. The linear model also fulfils a necessary function in the statements it provides concerning the level of explanation offered by, and the predictive efficiency of, a particular model equation.

In distinguishing between explanatory and predictive models the view is taken that

> *... every adequate explanation is said to provide a potential prediction, while successful prediction is not the same as successful explanation (Olsson, 1972, p.6).*

Echenique (1972, p.169) is of a similar opinion when she argues that a descriptive (explanatory) model is logically essential to any other type, since

> *... it is not possible to predict or plan without a previous description of the reality under study.*

In the present study, explanation takes precedence over prediction. It is only when it is considered that a satisfactory level of explanation has been achieved, that the predictive efficiency of a model is examined (and here attention is restricted to the locational choice models). This additional step is taken to assess a model's performance when data for a different set of individuals taken from the same population are entered in the explanatory equation.

The present chapter is devoted to modelling the first two outcomes of the residential relocation process: the decision to move, and the choice of residence. The following chapter is given over entirely to the establishment and testing of structural models of locational choice.

CHRISTCHURCH RESIDENTIAL MOBILITY SURVEY

1. Data Requirements for Residential Mobility Models

In both the brief outline in the previous section and the INTRODUCTION concerning the form of mobility models to be developed in the present study, it was indicated that the variable of direct interest (i.e. mobility behaviour, residence choice, the destination of a move) assumed the role of dependent variable - the remaining variables being classified as predictors.

The first part of the thesis (Chapters 2-5) has been concerned primarily with the classification of Christchurch's residential sub-areas in order that the outcome of an intra-urban move could be assigned a quantitative value for inclusion in locational choice models. Attention is now given to the steps taken to secure data relevant to the explanation and prediction of the principal outcomes of intra-urban residential mobility - at the individual household level.

The principal data requirements for model formulation include a sample of households:

1) a proportion of whom move to ownership property within the urban area during a specified time period, and
2) a remaining proportion who make no intra-urban shift during that period.

In the present study, an effort was made to obtain a representative sample of Christchurch's households and residential environments, thereby ensuring that the mobility models[1] had the potential for maximum generality. The 311 census districts within the Christchurch Urban Area (1971) were stratified in an attempt to increase the representativeness of area and household sampling. Stratification was achieved via principal axes analysis of the 14 population variables used to index the social and demographic structure of Christchurch's residential population (refer to analyses undertaken in Chapter 2; in particular, Table 2.5, and Figures 2.5 and 2.6).

A two-dimensional classification (employing the tenure status/life style and socio-economic status dimensions) formed the basis for the selection of the survey zones presented in Figure 6.1. Forty households within each of the 45 survey zones were randomly selected for questionnaire survey[2]. Wise's 1974 street directory provided a comprehensive listing of addresses for every street in the selected survey zones. Addresses were selected using random number tables.

Household data was obtained from a self-administered questionnaire which was delivered to the randomly selected households. A post-paid, addressed envelope was provided for the return of the questionnaire. Delivery of survey schedules occupied the period February to mid-March 1974; this constituted Phase 1 of the survey. Phase 2 involved a follow-up of those households who had indicated in their returned mobility survey schedule (see Appendix VI.1) that they anticipated changing residence during 1974. Unless there is some method by which households can be monitored during the period in which they are actually engaged in relocation activity, the quality of information collected either before or after the event suffers in some way. Retrospective mobility studies are faced with the problems of accurately measuring household satisfaction, attitudes and preferences in a *post hoc* research design; preference measures obtained in prospective mobility studies must be considered as in some measure unconstrained. The latter approach appears to present fewer methodological problems and is adopted for the present study.

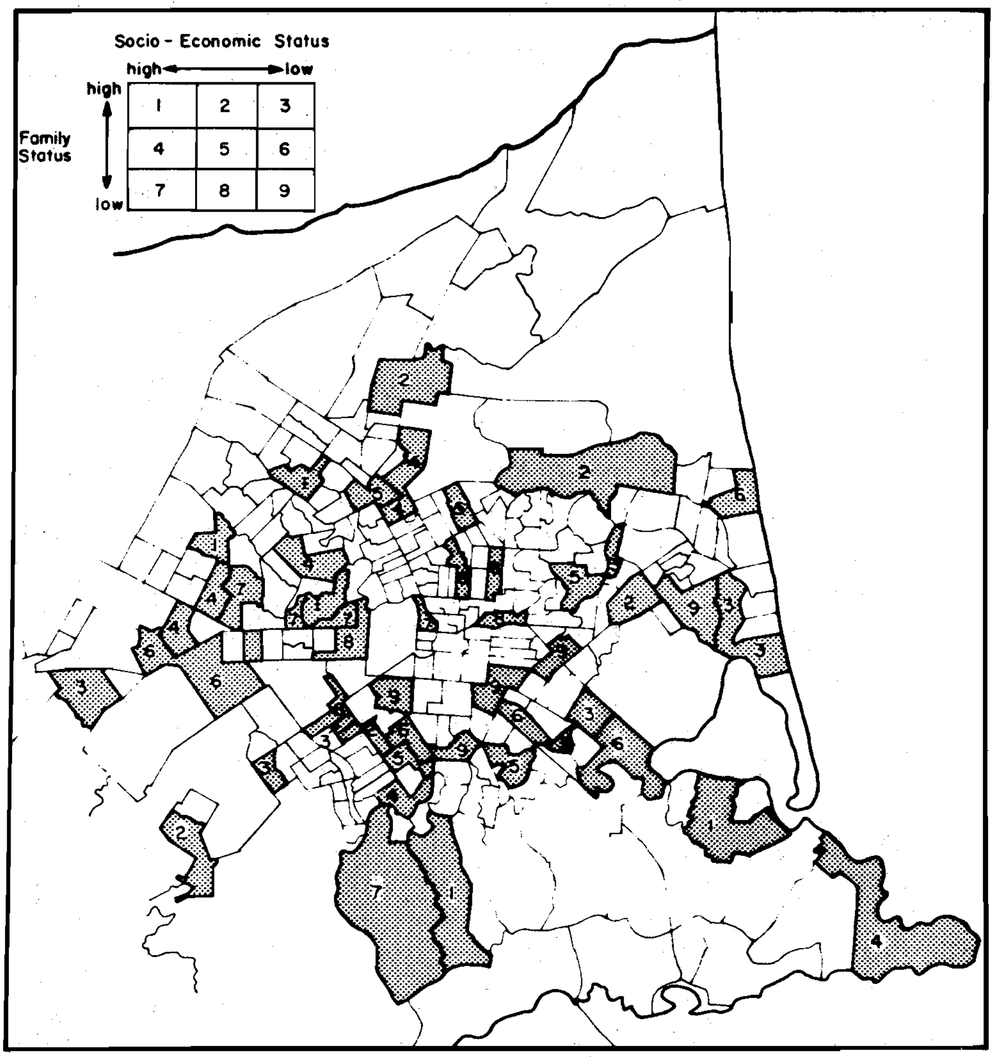


FIGURE 6.1 : SURVEY ZONES : RESIDENTIAL MOBILITY STUDY

Given the problems traditionally associated with postal or self-administered surveys (see Kish, 1965; Stimson and Ampt, 1972; Walmsley, 1973; Morgan, 1974), a pilot study of 30 households was undertaken in January 1974 to assess the performance of the questionnaire schedule (length, type of questions, format etc.), the level of response and the value of the follow-up of non-respondents. The proportion of completed schedules returned without follow-up was just under 40 percent; this figure rose by 11 percent upon delivery of a 'reminder' note one week after initial delivery of the questionnaire.

A similar figure held for the level of response in the principal survey (see Table 6.1). The figures for 'expected' and 'unexpected' stayers were derived after Phase 2. Expected stayers constituted those households who indicated (in Phase 1) their intention to stay and, in fact, did stay. Unexpected stayers are those who intended changing residence during 1974, but had not done so when contacted during Phase 2. Given the formidable difficulties associated with estimating the effect of nonresponse on the representativeness of the sample (particularly if all variables were to be examined), the analyses which follow are based on data from the 41 percent of returned schedules. The characteristics of this sample will be outlined in the following section.

2. Sample Profiles

The questionnaire employed in the present study offers the possibility of characterising surveyed households in almost 100 different ways. Clearly, some form of variable reduction is required in order to reduce the complexity of the models formulated in the following sections. Bunge (1974) has recently argued that if a general theory of location is to be found it

TABLE 6.1

MOBILITY SURVEY 1
CHRISTCHURCH 1974

	NUMBER	PERCENT
A. RESPONSE		
'EXPECTED' STAYERS	411	23
'UNEXPECTED' STAYERS	42	2
INTRA-URBAN MOVERS(OWNERSHIP)	135	8
INTRA-URBAN MOVERS(RENTAL)	74	4
INTER-URBAN MOVERS	40	2
INCOMPLETE QUESTIONNAIRES	36	2
SUB-TOTAL	738	41
B. NON-RESPONSE		
QUESTIONNAIRE RETURNED	85	8
QUESTIONNAIRE UNRETURNED	977	51
SUB-TOTAL	1062	59
TOTAL QUESTIONNAIRES DELIVERED	1800	100

will involve abstrating phenomena dimensionally and viewing their spatial behaviour or spatial patterning in terms of their dimensional aspects. In a less abstract vein, Hauser (1974) has made similar comments, and is of the opinion that the inter-correlation inherent amoung variables in social systems reflects the influence of a smaller number of underlying factors. In addition, multicollinearity and non-independence of variables pose problems for most parametric multivariate analyses (see Poole and O'Farrell, 1971; Buchanan, 1972). Recognition of such problems has resulted in the application of principal components analysis to reduce an interdependent variable set to a relatively few orthogonal dimensions, thereby satisfying some of the statistical requirements of multiple regression and multiple discriminant analysis while at the same time establishing models with a smaller and more general set of explanatory variables (dimensions).

Four batteries of variables relating to the structural and attitudinal characteristics of the surveyed households[3], and several features of their housing preferences, were subjected to principal components analysis. Components with eigenvalues greater than unity were rotated using the varimax criterion.

Three dimensions emerged from the component analysis of 11 household variables (Table 6.2). The components are readily interpreted as relating to the <u>life cycle</u> position, level of <u>socio-economic status</u>, and <u>household size</u> of the sample of surveyed households. The items relating to household satisfaction (Part 4 of questionnaire), housing preferences and locational preferences (Part 5 of questionnaire) were also subjected to

TABLE 6.2

HOUSEHOLD CHARACTERISTICS *

VARIABLES	COMPONENTS 1.	2.	3.	H^2
INCR. HHOLD SIZE	55			35
PREVIOUS TENURE	-65			45
AGE OF HEAD	89			80
FAM.LIFE CYCLE STAGE	82			73
DURATION OF RESIDENCE	73			56
HOUSEHOLD SIZE		94		91
NO.CHILDREN AT HOME		93		87
OCCUPATION OF HEAD			-81	65
INCOME OF HEAD			62	51
EDUCATION OF HEAD			-85	74
EDUCATION OF SPOUSE			-65	49
CUM. % VARIATION	26	44	65	
EIGENVALUE	3.3	2.0	1.8	

* VARIMAX ROTATED PCA
LOADINGS >50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. LIFE CYCLE
2. HOUSEHOLD SIZE
3. SOCIO-ECONOMIC STATUS

principal components analysis; the dimensions which emerged are outlined at an appropriate stage in the model-building process.

Family Status Characteristics

Several variables are employed to index the family status and life cycle positions of the surveyed households (see Table 6.3). The majority of the sample comprised married households - a bias in this direction must be expected in a survey of this nature - but there was no marked concentration in particular age groups or family life cycle stages. A range in household sizes was also achieved.

Economic Status Characteristics

The occupational status of the heads of the surveyed households[4] tended towards the middle and lower status occupations (a similar trend is evident across Christchurch occupations as a whole[5]). And inasmuch as any statement of income obtained via questionnaires can be completely relied upon, a range in weekly incomes is evident across the surveyed households.

Housing Characteristics

When surveyed, the majority of the 377 households (200 expected stayers, 42 unexpected stayers, 135 movers) who form the basis of the ensuing analyses were resident in single family dwellings. In fact, the sample survey proportion of 86 percent is almost identical to the Urban Area figure of 83 percent. In terms of tenure, the sample survey and Urban Area breakdown closely parallel one another, with 21 percent of households renting (26 percent for Urban Area) and the remainder either owning their property or being in the process of acquiring it (some form of mortgage being involved).

TABLE 6.3

HOUSEHOLD PROFILES :

CHRISTCHURCH MOBILITY SURVEY

VARIABLE	PERCENT OF SURVEYED HOUSEHOLDS *
DWELLING TYPE	
SINGLE FAMILY HOUSE	86
FLAT OR APARTMENT	12
OWNERSHIP FLAT	2
TENURE	
OWN HOUSE	54
MORTGAGED	25
RENTING	21
HOUSEHOLD SIZE	
SINGLE PERSON HOUSEHOLD	6
TWO PERSON HOUSEHOLD	27
THREE - FOUR PERSONS	43
OVER FOUR PERSONS	24
AGE OF HEAD	
< 20 YEARS	0
20-29 YEARS	23
30-39 YEARS	26
40-49 YEARS	17
50-64 YEARS	24
> 64 YEARS	9
NUMBER OF CHILDREN(AT HOME)	
NONE	26
ONE	18
TWO	25
THREE	20
> THREE	11
STAGE IN FAMILY LIFE CYCLE	
PRE-CHILD	11
CHILD-BEARING	20
CHILD-REARING	31
CHILD-LAUNCHING	13
POST-CHILD	17
WIDOWHOOD	7
MARITAL STATUS	
SINGLE	3
MARRIED	90
SEPARATED, DIVORCED	3
WIDOWED	4
OCCUPATIONAL STATUS OF HEAD	
STATUS GROUP 1 (HIGH)	5
STATUS GROUP 2	11
STATUS GROUP 3	10
STATUS GROUP 4	19
STATUS GROUP 5	19
STATUS GROUP 6 (LOW)	34
INCOME OF HEAD (WEEKLY GROSS)	
< $50	9
$50-75	14
$76-100	32
$101-150	27
> $150	16

* N=377

Summary

In terms of the structural characteristics of the surveyed households, the tabulated profiles reveal a sample which is representative of most household types resident within the Christchurch Urban Area. It follows that a sample of households such as this increases the potential generality associated with any residential mobility model derived from this data set.

RESIDENTIAL MOBILITY MODELS

The principal residential mobility models established in the present section are designed to estimate the likelihood of future intra-urban residential movement (within a specified time period) for a sample of urban households. The nature and composition of the resultant models can best be viewed in the context of their research antecedents.

Previous Research

Three major classes of residential mobility model exist in the published literature:

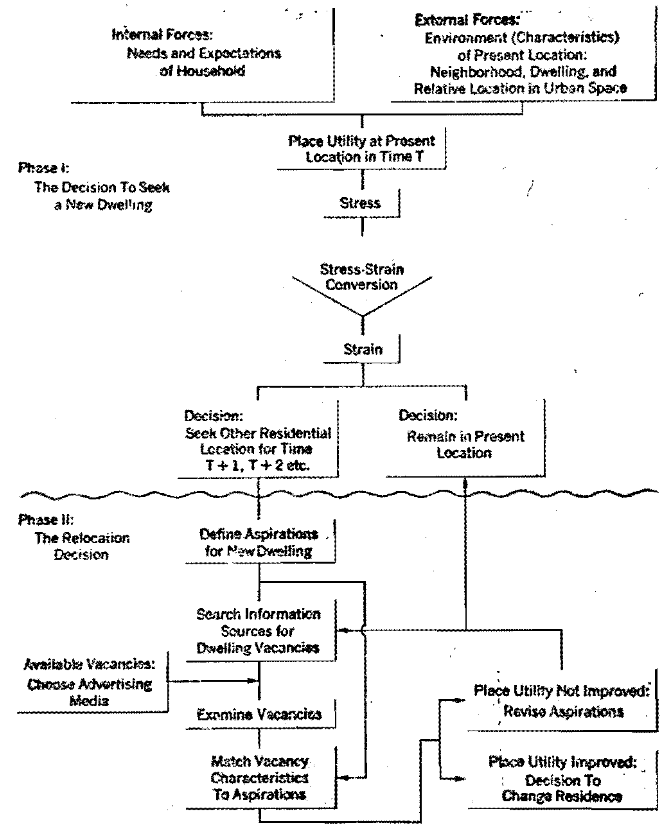
1) those which outline a conceptual framework in which the major components involved in the mobility process are specified (and in some cases linked);
2) retrospective mobility models which examine the past mobility behaviour of individuals or households (normally their mobility rate or duration of residence) in search of principal mobility determinants;
3) prospective mobility models, which attempt to predict the intra-urban mobility behaviour of households for some future time period.

1. Conceptual Models

While concentrating for the most part on internal migration, and drawing heavily upon the earlier work of

Ravenstein (1885, 1889) and Stouffer (1940, 1960), the paper by Lee (1966) marks the beginning of a period which has seen an increased focus on intra-urban migration. Although the factors advanced by Lee as being involved in the decision to migrate (factors associated with the area of origin and area of destination, intervening obstacles and personal factors) are closely aligned to gravity model/regional migration concepts, the paper does provide a schematic 'push-pull' model which can be adopted as a framework for intra-urban migration study. In fact, two subsequent review articles by Boyce (1969) and Sabagh et. al. (1969) have used the push-pull model as an organising scheme for outlining factors involved in the mobility decision process.

A more detailed appraisal of mobility research undertaken during the 1950's and early 1960's is provided by Simmons (1968) who categorises published empirical studies according to their explanation of the characteristics of movers, mobility determinants and spatial outcomes of the mobility decision. Generalisations about 'who moves' were central to 'classic' mobility studies by Rossi (1955) and Foote et. al. (1960), and form the basis for the more detailed analyses of duration of residence and mobility rates (discussed in the following section). The bulk of more recent research, however, has been devoted to the study of the movement decision. This development has been a direct result of the stimulus injected into urban studies by the 'behavioural approach' - an approach which is concerned with an investigation of the processes underlying spatial behaviour (see Pocock, 1971; Golledge, Brown and Williamson, 1972; Johnston, 1974c; and Cox, 1974 for a review). Brown and Moore's (1970) conceptualisation of the residential location decision process[6] (see Figure 6.2) is an exemplar of



* Figure reproduced from L.A. Brown and E.G. Moore, "The intra-urban migration process: a perspective." *Geografiska Annaler* Series B, Vol 52B, No 1 (1970) as reprinted in L.S. Bourne (1971)

FIGURE 6.2 : THE INTRA-URBAN MIGRATION PROCESS

a behavioural model, focussing on individual households (needs, expectations, etc.), and their interaction (place utility, stress, strain) with the residential environment (relative location, neighbourhood and dwelling characteristics).

The specification of two outcomes from Phase 1 of the Brown-Moore model is consistent with Moore's (1969) earlier arguments for the adoption of a mover-stayer framework in residential mobility research. While this represents an advance over earlier studies which focussed solely on mover households (see, for example: Munson, 1956; Whitney and Grigg, 1958; Leslie and Richardson, 1961; Ross, 1962; Kalbach, Myers and Walker, 1964), a question still remains as to the manner in which the mover-stayer continuum can best be incorporated within an empirical residential mobility model. Morrison (1973) suggests that individuals be arrayed along a continuum that ranges from 'easily movable' to 'virtually immobile'. Theoretically elegant as this may be, there are obvious problems of calibration when a continuous scale is envisaged.

The few remaining studies which have attempted to outline a mobility schema have chosen to identify particular mover-stayer states - a nominal classification which can, in some cases, assume the characteristics of an ordinal scale. Kenkel (1965), for example, has outlined a number of possible outcomes of family moving <u>discussions</u>: determined nonmovers, tentative nonmovers, tentative movers, determined movers, the unsettled. Several factors are also outlined to account for the difference in the outcomes of family moving discussions. Among these are household-related characteristics such as family life cycle stage, changing occupational demands, changing social status and family values and goals, as well as a number of lesser known influences such as the roles adopted by the

	Mobil-ity	Motil-ity	Moti-vation	
(a)	0	0	0	Autistic individuals; the very poor elderly; apathetic poor
(b)	0	1	0	Middle income married group; elderly homeowners; young married couples; socially cohesive groups (based on religion or ethnicity)
(c)	0	0	1	Beatniks; ghetto poor; low income groups; young married couples
(d)	1	1	1	Upwardly, socially mobile groups; middle class America
(e)	1	1	0	Forced residential relocation groups; persons experiencing unexpected and stressful events
(f)	1	0	1	Hobo, beatnik; a sudden heir; the winner of a quiz game
(g)	1	0	0	Destitute groups uprooted by urban renewal

0 = FALSE

1 = TRUE

FIGURE 6.3 : SIMPLIFIED BEHAVIOURAL SCHEMA FOR RESIDENTIAL MOBILITY (After Golant, 1973)

adult members of the household in moving discussions, together with the content and rationality of the discussions themselves.

A somewhat different approach is undertaken by Golant (1973) who sets up a schema for defining an individual's movement behaviour in terms of three behavioural components: mobility, motility (the capacity of becoming mobile) and motivation. Figure 6.3 displays the schema and associates various population groups with each of the 'mobility' situations. The schema has the advantage of reinforcing the differentiation of a variety of mover and stayer types, but has the disadvantage of producing a rather gross category within each of the mobile and non-mobile sections (i.e., *upwardly, socially mobile ... middle class ...* and *middle income married ...*).

As a result of the two-phase mobility survey undertaken for the present study, it is possible to isolate, a posteriori four principal household types (see Figure 6.4).

Phase I Household Mobility Plans	Phase II Household Mobility Behaviour	Household Type (A Posteriori Designation)
Planned Stayers	Stayed	Expected Stayers
Planned Stayers	Moved	Unexpected Movers
Planned Movers	Stayed	Unexpected Stayers
Planned Movers	Moved	Expected Movers

FIGURE 6.4

MOVER-STAYER SCHEMA

A schema such as this identifies, in addition to the polar types (expected stayers, expected movers), a second set of groupings which refer to households who have, perhaps, undergone forced residential relocation or have experienced unexpected stressful events (the unexpected movers); or households whose relocation plans were possibly impeded by a lack of information about residential opportunities, an inability to raise sufficient finance or an absence of residences of the type sought during the period of search (the unexpected stayers). The task then becomes one of determining those factors underlying group separation.

2. Retrospective Mobility Models

Retrospective mobility models have dealt, for the most part, with the number of previous moves made by households, or their duration of residence. In attempting to explain past mobility behaviour most studies have emphasised structural mobility determinants (e.g. socio-economic status, life cycle, tenure status) largely because respondent explanations of previous behaviour may be, in some cases, post hoc rationalisations.

The fact that all possible mobility - related influences (e.g. household attitudes, levels of satisfaction with residential environment, etc.) cannot be incorporated within a retrospective model casts some doubt on its utility, as does the fact than an explanation of past mobility behaviour need not contribute to the explanation and prediction of future moves[8] - and it is with future residential mobility that the present section of the thesis is principally concerned.

Since several structural variables are potentially relevant to both retrospective and prospective mobility models, it seems appropraite to examine retrospective residential mobility behaviour at this stage. In summarising the results of several duration of residence/migration rate[9] studies, Simmons (1974) points to the dominance of life cycle stage as a determinant of intra-urban migration. The rationale for such a conclusion relates, for the most part, to changes in dwelling, neighbourhood and access requirements which occur at different stages in the life cycle of an individual or household. Residential relocation permits adjustment to such a changed need set (see Rossi, 1955; Leslie and Richardson, 1961; Butler et. al., 1964, 1969; Goldstein, 1973).

Age of head has been found by Speare (1970) and Pickvance (1973, 1974) to have important effects on migration, independent of life cycle position. Consequently, both warrant consideration in any mobility model. A number of studies have also demonstrated that a household's retrospective mobility rate and propensity for future mobility is influenced (in fact, declines) due to the operation of a 'duration-of-stay' effect (Morrison, 1967, 1971; Land, 1969). This effect, known also as cumulative inertia or cumulative residential stability, is the basis for the migration model formulated by McGinnis (1968), the rationale being that residence in the same place steadily strengthens interpersonal ties and community integration, gradually 'trapping' households the longer they remain in one locality. Housing tenure is another variable which has been found to have a significant bearing, particularly in North American, Australian and New Zealand society, on a household's past and future residential mobility behaviour (Ross, 1955; Foley, 1960; Speare, 1970; Pickvance, 1973).

Several reasons can be advanced for this, among the more important being predilection toward homeownership. When homeownership has been achieved a goal has been reached[10] and a major impetus for subsequent mobility is removed. Prior to achieving ownership, rental accommodation is often considered little more than a temporary expedient and is quite likely to be exchanged for more suitable accommodation if such becomes available.

Household socio-economic indicators such as occupation, education and income have generally performed poorly in intra-urban residential mobility models (see Butler et. al., 1969). They are retained for inclusion in the prospective residential mobility models, since the state of the housing market and the availability of finance during certain periods may preclude certain income groups from successfully concluding a housing transaction.

The intercorrelation matrix presented in Table 6.4 provides an indication of the strength of zero-order associations among the respondents on average duration of residence and several explanatory variables[11]. It would appear as though a 'duration-of-stay' effect (measured by number of years at present location) has been operating to dampen the mobility activity among a subgroup of households in the present survey (in particular, those who own their homes and are in the middle and latter stages of the life cycle). Since a number of other variables were found to have moderate correlations with the criterion variable, multiple regression analysis was undertaken in an attempt to raise the level of explanation of the duration of residence model. After the first stage in the regression analysis (see Table 6.5), four of the remaining six variables had significant partial correlations with the

TABLE 6.4

INTERCORRELATION ANALYSIS
FOR DURATION OF RESIDENCE MODEL

VARIABLE								
TENURE STATUS	100							
AGE OF HEAD	-43	100						
LIFE CYCLE STAGE	-40	78	100					
OCCUPATION OF HEAD	04	02	09	100				
INCOME OF HEAD	08	-26	-33	-37	100			
EDUCATION OF HEAD	-09	17	26	59	-41	100		
YEARS RESIDENCE	-39	56	47	08	-20	23	100	
AVE.DURATION RESID.	-35	56	49	05	-22	17	70	100

TABLE 6.5

STEPWISE REGRESSION ANALYSIS
OF DURATION OF RESIDENCE INDICANTS

STEP	VARIABLE ENTERED	R	PARTIAL CORRELATION OF REMAINING PREDICTORS WITH DEPENDENT VARIABLE	
1	YEARS RESIDENCE	0.70		
2	AGE OF HEAD	0.73	TENURE STATUS	-0.04
			LIFE CYCLE STAGE	0.08
			OCCUPATION(HEAD)	0.00
			INCOME OF HEAD	-0.06
			EDUCATION(HEAD)	0.00

dependent variable: age of head (0.28), stage in life cycle (0.26), tenure (0.12) and income of head (0.11). In the following stage, the variable 'age of head' (the highest partial) is added to the equation, raising R to 0.73 and reducing the remaining partial correlations to near-zero. The reason for this is evident if reference is made once again to the table of intercorrelations: age of head and stage in life cycle are multicollinear, and age of head is moderately correlated with tenure status.

With the existence of interdependencies within the variable set, some adjustment is called for. One of a pair of variables which are collinear could be excluded from consideration, but this would introduce the problem of which variable to drop. In the present case, for example, it had been indicated that 'age' and 'life cycle stage' were conceptually independent variables, capable of exerting an independent effect on a criterion variable. An alternative procedure, first advocated by Kendall (1957), employs principal components analysis to reduce the original variable set to a smaller number of orthogonal dimensions which are then subjected to regression analysis (see Hauser, 1974, for a recent example within a geographic context). The variables presented in Table 6.2 were refactored (minus the 'duration of residence' variable), and an almost identical three dimensions were input as independent 'variables' into a stepwise regression analysis. The life cycle dimension was drawn into the equation first (R = 0.72), followed by the household size dimension (R = 0.73), then the socio-economic status dimension (R = 0.74). The resultant increase in explanation which follows from the use of orthogonal dimensions as opposed to variables with varying degrees of interdependence is negligible, and, as Buchanan

(1972) has observed, a possible disadvantage of dealing with a reduced (via component analysis) data set is the increased difficulty associated with interpreting the exact nature of the regression model in terms of the original variables. The fact that Butler et. al., (1969, p.59) suggest that the 'duration-of-stay' effect (on mobility) is indistinguishable from the life cycle effect - the likely cause being that life cycle stage is mirrored in length of residence - tends to add strength to the latter 'dimensional' model in which the life cycle factor emerges as the principal determinant of a household's migration rate.

3. Prospective Mobility Models

The objective of prospective mobility models is to predict, from a group of randomly selected households, those who can be expected to undertake an intra-urban residence shift within some specified time period - one year, five years, ten years, etc. Few studies have explicitly set out to formulate a model for this particular aspect of residential mobility behaviour (the exceptions being Clark and Cadwallader, 1973; Pickvance, 1974; and Speare, 1974), although there are many studies which have investigated the relationship of a particular factor to residential mobility. Several possible underlying factors have been advanced, namely: residential dissatisfaction, residential stress, contextual position, the occurrence of particular events within a household, and the structural and attitudinal characteristics of the household itself. Attention in the present section will focus, in turn, upon certain of these mobility determinants, culminating finally in an overall assessment of their relative importance in predicting the likelihood of intra-urban movement[12] for a group of 277 households resident in Christchurch in 1974.

a) Residential Satisfaction

A recent path analysis study by Speare (1974) found residential satisfaction to be one of the principal predictors of prospective mobility and that the effects of 'background' variables (e.g. age of head, duration of residence, tenure, crowding index and friends and relatives index) on mobility were mainly indirect effects which acted through the residential satisfaction variable. The total variation in the mobility variable explained by residential satisfaction was, however, relatively small (20 percent), with duration of residence and tenure status explaining an additional 4 percent of the variance when included in the regression model. Improvement in level of explanation would appear to rest either on an improvement in the method of measuring satisfaction, or the isolation of additional predictor variables (or both).

An important feature of Speare's study is his stated preference for a dissatisfaction-based rather than a stress-based model of residential mobility; his rationale being

> *... to avoid the connotation of mental tension*[13] *(Speare, 1974, p.175)*.

Instead, it is argued that if dissatisfaction passes some (unspecified) threshold[14], then the household will develop a desire to move. Although Speare does not attempt to determine what this threshold may be for individual households or the sample as a whole, his residential mobility model is superior from both a methodological (in that it is simpler) and an explanatory (higher proportion of explained variation) point of view to the locational stress model of Clark and Cadwallader (1973) and Clark (1974).

The latter model conceptualises the decision to move as being :

> *... a function both of the household's present level of satisfaction and of the level of satisfaction it believes may be attained elsewhere. The difference between these levels can be viewed as a measure of 'stress' created by the present location. (Clark and Cadwallader, 1973, p.31).*

Operationalisation of this model requires that measurement be made of a household's present level of satisfaction (7 point scale) together with a household's assessment of the ease with which a more desirable location could be found elsewhere in the city (7 point scale). It is argued that the greatest amount of stress is experienced when the household thinks that it is very easy to find a better residential environment elsewhere, at the same time as being very dissatisfied with its present location. It is in this situation that the household is most likely to exhibit a strong desire to move[15].

Since Clark and Cadwallader consider that it is necessary to extend a household satisfaction - residential mobility model to take into account the household's expectation of reducing levels of dissatisfaction at alternative locations, then information on the following relationships should have been specified by way of justification:

1) the association between a household's level of satisfaction and its counterpart stress measurement (for individual stressors and the battery as a whole). If both indices are found to be in concordance then there would seem to be no benefit in an extension beyond a measure of household satisfaction.

2) the association between residential mobility and household satisfaction and between residential mobility and household stress require examination for the existence of any significant differences in levels of explanation.

The poorer performance of the locational stress models (see Clark and Cadwallader, 1973, p.37; Clark, 1974, p.74; explained variation did not reach 15 percent) in comparison to the satisfaction model of Speare (1974) provides further inducement for restricting attention to the relationship between a household's level of residential satisfaction and its intra-urban migration behaviour.

Measuring Residential Satisfaction

In reviewing studies concerned with residential satisfaction in urban environments, two different approaches are revealed. On the one hand, there are studies such as that by Fried and Gleicher (1961) which argue that resident satisfaction derives in large part from the

> *... associations maintained among the local people and from their strong sense of identity to the local places.*

Ermuth (1974) has adopted a similar approach in which a number of sociological scales are employed (Group Cohesiveness, Anomia, Local-Cosmopolitan) to measure an individual's social interaction within, isolation from and local identification with its neighbourhood (all three measures together indicate the individual's overall level of satisfaction with his or her residential environment). Such an approach would appear more in line with a study concerned with neighbourhood identification (see Sharma, 1975) than residential satisfaction.

The second group of studies could be broadly labelled as empirical-deductive in that they attempt to identify, from a group of individual dwelling and neighbourhood-related features, a smaller and more general set of dimensions of residential satisfaction[16]. In a similar manner to the studies of Butler et. al., (1969) and Onibokun (1973), surveyed households in

Christchurch were asked to rank, on a 4-point scale, their degree of satisfaction with 34 selected environment-related variables (see Part 4 of Questionnaire, in Appendix VI.1), yielding a 377 x 34 data matrix[17]. This matrix was factored (principal axes, varimax rotation) in order to resolve it into a few critical dimensions and determine any tendency for clustering among the variables. The results of the analysis are presented in Table 6.6. There is no single dimension which, by virtue of its contribution to the total explained variation, dominates the component structure. Instead there are several dimensions which highlight important sources of resident dissatisfaction in relation to the individual dwelling, the neighbourhood and the position of the dwelling relative to other locations within the city.

In terms of a household's evaluation of satisfactoriness of its dwelling, it is apparent that the provision of space within the dwelling unit (as indexed by number and size of rooms, number of bedrooms) emerges as an important but separate area of concern to that of the style of the building (interpreted rather broadly by variables relating to the condition - and indirectly, the age - of the unit; the layout and size of rooms). Since Onibokun was largely concerned with features external to the dwelling, his study is not of direct relevance to these particular dimensions. Butler et. al., on the other hand, included dwelling-related features in their inventory, with a single dimension relating particularly to space, emerging from their factor analysis.

By far the largest number of dimensions to emerge in the Christchurch study relate to aspects of the neighbourhood environment. Reputation, type of neighbours, the physical character of the area, the distance to and quality of the

TABLE 6.6

HOUSEHOLD SATISFACTION WITH
RESIDENTIAL ENVIRONMENT *

VARIABLES	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	H^2
	COMPONENTS										
NBD APPEARANCE	62										64
NBD REPUTATION	76										76
O/P OPINION:NBD	81										76
CLEANLINESS OF NBD	56										66
FRN OPINION:NBD	84										75
FRN OPINION:HOUSE	52		56								66
PROX. TO PUB.TRANSP.		76									64
BUS SERVICE FREQUENCY		79									69
DISTANCE CBD		53									55
DISTANCE SHOPS		53									44
GARAGE SPACE			60								56
HOUSE STYLE			74								71
SIZE OF ROOMS			53					-50			66
LAYOUT OF ROOMS			72								69
CONDITION OF HOUSE			71								62
QUALITY NBD SCHOOLS				69							65
DISTANCE TO SCHOOLS				81							71
PROPERTY RATES				68							63
DISTANCE TO RELATIVES					86						77
DISTANCE TO FRIENDS					77						74
AMOUNT OF PRIVACY						66					59
QUIETNESS OF NBD						70					66
BUILDING DENSITY						66					64
LEVEL OF TRAFFIC						64					63
LOC'N RECREAT'N FACIL.							-72				72
DISTANCE TO PARKS							-71				68
NUMBER OF BEDROOMS								-86			81
NUMBER OF ROOMS								-87			85
PROVISION OF SERVICES									78		74
TYPE OF NEIGHBOURS										74	74
NOISE FROM NEIGHBOURS										58	66
FRIENDLINESS OF N'BOURS										77	74
SIZE OF SECTION											43
DISTANCE TO WORK(HEAD)											37
CUM. % VARIATION	11	18	27	33	38	46	51	58	62	68	
EIGENVALUE	8.8	2.5	2.4	1.8	1.4	1.4	1.2	1.1	1.1	1.0	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS >50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. NEIGHBOURHOOD:REPUTATION
2. ACCESSIBILITY TO SERVICES,FACILITIES
3. HOUSE STYLE
4. SCHOOLS
5. DISTANCE TO FRIENDS,RELATIVES
6. NEIGHBOURHOOD:PHYSICAL ENVIRONMENT
7. ACCESS TO RECREATIONAL AREAS
8. DWELLING SIZE
9. PROVISION OF SERVICES
10. TYPE OF NEIGHBOURS

schools, and the provision of services all appear to be relatively independent aspects of a household's image of its neighbourhood, or at least its satisfaction with it. The remaining satisfaction-dissatisfaction dimensions relate to the dwelling relative to centres of out-of-home activity: shops, CBD, friends, relatives and recreation activities. The degree of congruence between the abovementioned factors and those from the studies by Butler et. al., (1969) and Onibokun (1973)[18] suggest that the present study has isolated the principal dimensions on which households can be located according to the level of dissatisfaction they experience as residents in a particular residential environment.

The value of employing principal components analysis in an exercise such as this is that all the variables having common characteristics, as reflected by their original scores, load highly on the same satisfaction-dissatisfaction dimension. At a later stage in the Chapter when the individual dimensions are being examined for their contribution to a separation of mover-stayer groupings, satisfaction factor indices[19] will be employed as the basis for discrimination.

b) Household Characteristics and Household Events

That the social and demographic structure of a household affects its mobility inclinations is a statement which has been consistently advanced in studies of intra-urban migration. Certain household characteristics, especially life cycle stage, tenure status, household size and in some cases socio-economic attributes, have been found to distinguish mover from non-mover groups (see earlier section on retrospective mobility models). To some extent it may be argued that such variables are concomitants of household mobility; their connection with mobility behaviour being largely implicit and couched in terms such as 'the need for certain types of housing at particular stages of the life cycle'.

This does not remove their value as discriminatory variables, but it does suggest that additional indices, relating to the occurrence of mobility-related household <u>events</u>, need to be incorporated within a mover-stayer model in order to improve its level of explanation (and possibly prediction). Some of the more significant mobility-related household changes include:

1) An increase in family size as a result of the birth or adoption of a child (particularly where the household's housing is found to be inadequate to the demands generated by these shifts in composition). Familistic attitudes are often heightened in such situations, and may be manifested in the form of a change in tenure or relocation to areas considered to possess attributes more conducive to child-rearing.

2) Contraction in household size during the child-launching stage of the family life cycle often gives rise to a re-evaluation of the space requirements for such households. The child-launching stage (and the latter phase of the child-rearing stage) has also been considered as the period in which a household is most likely to move to demonstrate achieved status (Abu-Lughod and Foley, 1960; Butler, Sabagh and Van Arsdol, 1964).

3) Progression through the life cycle is also accompanied by job-related changes. Promotion, substantial increase in salary or an addition to household income through the entry of a second member of the family into the workforce is often sufficient to permit certain social mobility aspirations - such as change of address - to be achieved.

An assessment of the nature and extent of change being experienced or likely to be experienced by households in the Christchurch mobility survey was gauged by a series of questions focusing on possible household events (see Part 2 of Questionnaire, Appendix VI.1). These events include:

1) increase in household size due to arrival of a child; or
2) a relative;
3) one or more children left home;
4) spouse began or resumed work;
5) increase in salary - head;
6) change in job - head;
7) change in job - spouse;
8) promotion - head.

When the breakdown of household responses to the eight events are examined (Table 6.7), it is evident that certain household changes are more likely to occur within some specified time period than others - in particular those relating to an increase in family size due to birth, a spouse resuming work, or some job-related change. The extent to which these individual events, or some measure of overall household change (e.g. sum of all events) correlate with residential mobility behaviour, is examined in the section which follows.

Establishing Mover-Stayer Models

Given the range of variables which have been introduced as possible discriminators of mover and stayer groups, it is now appropriate to assess their contribution to overall group separation within the framework of the mover-stayer schema outlined in Figure 6.4. A three-group model similar to that outlined by Speare (1974, p.177): expected movers, expected stayers, unexpected stayers and two two-group models (expected movers versus expected and unexpected stayers;

TABLE 6.7

PERCENTAGE DISTRIBUTION OF RESPONSES
TO HOUSEHOLD CHANGE ITEMS

ITEM	MEAN	SIGMA	RESPONSE MODE * 0	1	2
1	1.77	0.45	1	21	77
2	1.94	0.35	2	2	95
3	1.85	0.43	3	10	88
4	1.72	0.53	4	20	76
5	1.72	0.54	4	19	76
6	1.76	0.51	4	16	80
7	1.84	0.46	4	9	87
8	1.79	0.51	3	15	81

* 0 : NOT APPLICABLE
1 : CHANGE
2 : NO CHANGE

ITEMS 1-8 ARE LISTED IN PART 2 OF QUESTIONNAIRE expected movers versus expected stayers) form the basis for the following analyses.

Employing contingency table analyses, a comparison of the variation in household characteristics across the mover-stayer groups gives an initial indication of those variables which appear to be most strongly involved in the decision to move or stay (see Table 6.8). Strongest group separation occurs with variables relating to the life cycle characteristics of households and household events. Separation is not quite as strong with indicants of household residential satisfaction and socio-economic status.

With one exception, similar levels of separation held for both the two group and three group case, thereby raising the question of the need for retaining the three-group mover-stayer case in subsequent analyses. When the profiles of expected and unexpected stayer households are compared (Table 6.9) it is apparent that there are several areas of significant variation. In particular, a higher proportion of unexpected stayers are renters, they are younger and their average duration of residence is lower. So at the present stage of analyses it may be premature to discard one or other of the two stayer groups.

The next step involves selecting the set of variables which will differentiate the mover-stayer groups better than any other linear combination of variables. The individual correlations between the mover-stayer groupings[20] and household changes (Table 6.10) reveal a significant but relatively low level of association. The total number of 'events' experienced, or likely to be experienced by a household emerges as the prinicipal indicant of mobility behaviour, and is retained for inclusion in subsequent mover-stayer models.

TABLE 6.8

MOVER-STAYER PROFILES

VARIABLE	TWO GROUP CASE CHI SQ	DF	TAU C	GAMMA	THREE GROUP CASE CHI SQ	DF	TAU C	GAMMA
INCR.IN HHOLD SIZE	28.4	2	-.21	-.56	29.9	4	-.17	-.52
TOTAL EVENTS(+/-12MTHS)	44.9	6	.32	.45	60.8	12	.29	.44
DWELLING TYPE	48.1	2	.23	.79	49.4	4	.18	.75
TENURE	91.6	3	.36	.56	98.9	6	.31	.53
NUMBER OF BEDROOMS	40.6	6	-.23	-.35	42.3	12	-.16	-.27
HOUSEHOLD SIZE	* 2.3	8	.01	.02	* 7.5	16	.01	.02
AGE OF HEAD	50.6	7	-.37	-.50	60.0	14	-.33	-.47
NUMBER OF CHILDREN(AT HOME)	* 11.3	8	-.15	-.20	* 21.6	16	-.15	-.21
STAGE IN FAMILY LIFE CYCLE	66.4	6	-.41	-.54	97.0	12	-.37	-.52
MARITAL STATUS	* 7.2	4	.02	.10	* 15.5	8	.01	.04
DURATION OF RESIDENCE	75.3	7	-.47	-.64	86.8	14	-.40	-.59
OCCUPATION OF HEAD	28.0	7	-.20	-.27	61.6	14	-.20	-.28
WORKING SPOUSE	* 3.5	2	.08	.14	* 6.3	4	.05	.10
INCOME OF HEAD	23.9	5	.18	.25	29.4	10	.16	.24
EDUCATION OF HEAD	32.8	9	-.29	-.39	51.3	18	-.27	-.38
YEARS RESIDENCE	70.4	4	-.45	-.60	78.9	8	-.37	-.53
LIFE CYCLE FACTOR	74.6	5	-.44	-.61	87.0	10	-.39	-.58
HHOLD SIZE FACTOR	* 5.9	5	-.11	-.17	* 10.3	10	-.10	-.16
SES FACTOR	24.9	4	.22	.32	34.3	8	.21	.33
SATISF:NBD REPUTATION	* 9.4	5	.12	.19	26.6	10	.09	.15
SATISF:ACCESS TO SERVICES	19.9	5	.01	.01	21.5	10	-.01	-.01
SATISF:HOUSE STYLE	29.8	5	.18	.28	37.0	10	.16	.26
SATISF:SCHOOLS	44.5	5	-.22	-.32	44.8	10	-.16	-.26
SATISF:DIST.TO FRIENDS,REL.	35.9	5	-.07	-.10	39.2	10	-.07	-.12
SATISF:NBD PHYS.ENV'T	21.1	5	.09	.13	26.0	10	.10	.16
SATISF:ACCESS TO RECREATION	* 10.6	5	-.09	-.14	* 10.9	10	-.07	-.11
SATISF:DWELLING SIZE	20.7	5	-.18	-.27	26.6	10	-.17	-.29
SATISF:PROVISION OF SERVICE	21.8	5	-.11	-.17	23.7	10	-.10	-.16
SATISF:TYPE OF NEIGHBOURS	18.5	5	.16	.25	26.2	10	.15	.24

* CHI-SQUARE NOT SIGNIFICANT AT P=.05 LEVEL

TABLE 6.9

PROFILES OF 'EXPECTED' VS.'UNEXPECTED'
STAYER HOUSEHOLDS

VARIABLE		CHI SQ	DF	TAU C	GAMMA
INCREASE IN HHOLD SIZE	*	2.0	1	-.05	-.29
TOTAL EVENTS(+/-12MTHS)		16.6	4	.17	.41
DWELLING TYPE	*	2.9	2	.02	.30
TENURE		18.5	2	.13	.40
NUMBER OF BEDROOMS	*	2.0	4	.03	.07
HOUSEHOLD SIZE	*	5.2	8	.02	.03
AGE OF HEAD		11.8	5	-.16	-.34
NUMBER OF CHILDREN(AT HOME)	*	10.2	7	-.11	-.24
STAGE IN FAMILY LIFE CYCLE		29.3	6	-.21	-.44
MARITAL STATUS		9.7	3	-.02	-.14
DURATION OF RESIDENCE		15.7	7	-.17	-.38
OCCUPATION OF HEAD		34.6	6	-.15	-.32
WORKING SPOUSE	*	2.8	2	-.03	-.07
INCOME OF HEAD	*	5.7	5	.10	.23
EDUCATION OF HEAD		15.9	8	-.17	-.38
YEARS RESIDENCE	*	8.2	4	-.11	-.24
LIFE CYCLE FACTOR		19.7	5	-.18	-.43
HOUSEHOLD SIZE FACTOR	*	4.8	4	-.05	-.13
SES FACTOR	*	9.1	4	.14	.34
SATISF:NBD REPUTATION		24.1	5	-.01	-.01
SATISF:ACCESS TO SERVICES	*	1.7	4	-.04	-.11
SATISF:HOUSE STYLE	*	10.0	5	.07	.18
SATISF:SCHOOLS	*	.1	4	.01	.03
SATISF:DIST.TO FRIENDS,REL.	*	5.4	5	-.08	-.21
SATISF:NBD PHYS.ENV'T	*	7.5	5	.11	.29
SATISF:ACCESS TO RECREATION	*	.5	5	.01	.02
SATISF:DWELLING SIZE	*	10.7	5	-.13	-.35
SATISF:PROVISION OF SERVICE	*	2.3	5	-.05	-.12
SATISF:TYPE OF NEIGHBOURS	*	8.4	5	.10	.23

* CHI-SQUARE NOT SIGNIFICANT AT P=.05 LEVEL

TABLE 6.10

RELATIONSHIP BETWEEN HOUSEHOLD
CHANGES AND DECISION TO MOVE

NATURE OF HOUSEHOLD CHANGE	THREE GROUP CASE	TWO GROUP CASE
BIRTH OR ADOPTION OF CHILD	-0.28	-0.27
ARRIVAL OF PARENT,RELATIVE	-0.15	-0.15
CHILD LEAVES HOME	-0.16	-0.14
WIFE RESUMES WORK	-0.19	-0.15
INCREASE IN SALARY(HEAD)	-0.19	-0.11
JOB CHANGE(HEAD)	-0.25	-0.19
WIFE CHANGES JOB	-0.25	-0.23
PROMOTION(HEAD)	-0.21	-0.11
TOTAL EVENTS	0.34	0.30

Similar levels of association are revealed by the correlations between the individual indices of satisfaction (see Note 19) and residential mobility behaviour, although considerably greater variation exists in the performance of individual indices (Table 6.11). Those which have near-zero associations with the mobility outcome are access-related components (services and facilities, friends and relatives) and the single-variable index, provision of services. This suggests that whereas individual households may assert a certain level of dissatisfaction over their relative accessibility or level of service provision, such dissatisfactions do not figure prominently in a decision to move or stay. Dwelling and neighbourhood-related indices perform as well, and in some cases better than an overall measure of satisfaction level which combines satisfaction-dissatisfaction scores from all 10 indices. An overall measure of satisfaction level is retained for multivariate modelling, but the three indices with negligible association with mobility outcome are not included in its computation, the effect being to slightly improve its correlation with mobility outcome.

For the establishment of a multivariate mover-stayer discriminant model[21], several variables relating to the structural characteristics of households are added to the measures of household change and household satisfaction. Given that structural variables such as stage in life cycle, years at previous residence, previous tenure, age, income and occupation of head, and average duration of residence have been found to make an individual contribution to separation of mover-stayer groupings (see Table 6.8), it is still quite probable that a number will prove to be redundant when considered together as a result of the overlap which exists among some of the variables.

TABLE 6.11

RELATIONSHIPS BETWEEN HOUSEHOLD SATISFACTION INDICES AND DECISION TO MOVE

SATISFACTION INDEX	THREE GROUP CASE		TWO GROUP CASE	
NEIGHBOURHOOD:REPUTATION	0.21		0.18	
ACCESS TO SERVICES,FACILITIES	0.06	*	0.07	*
HOUSE STYLE	0.31		0.29	
SCHOOLS	0.20		0.21	
DISTANCE TO FRIENDS,RELATIVES	0.03	*	0.03	*
NEIGHBOURHOOD:PHYSICAL ENV'T	0.27		0.24	
ACCESS TO RECREATIONAL AREAS	0.17		0.16	
DWELLING SIZE	0.29		0.25	
PROVISION OF SERVICES	0.01	*	0.00	*
TYPE OF NEIGHBOURS	0.26		0.24	
OVERALL SATISFACTION LEVEL	0.26		0.24	
ADJUSTED SATISFACTION LEVEL	0.27		0.25	

* CORRELATION COEFFICIENT NOT SIGNIFICANT AT P=0.05 LEVEL

Weiner and Dunn (1966) have examined this problem and suggest that stepwise regression analysis be used to isolate the most important variables prior to undertaking multiple discriminant analysis.

Stepwise regression analyses were undertaken on 9 predictor variables against the two-group and three-group mobility criterion. The highest coefficient of multiple determination and the lowest standard error of estimate were used to select the stage at which no additional variables were to be included in the model equations (Griffiths, 1968; Brown, 1974). Variables in the equation up to that point are those which together explain the greatest amount of variation in the dependent variable and additionally, can be expected to contribute most to the discrimination among the designated mover-stayer groupings (see Table 6.12).

The stepwise regression analyses have suggested several variables which appear to play a major role in distinguishing the mover-stayer groupings. Foremost among these are:

1) family life cycle position - a factor usually advanced to summarise a number of dwelling-related household needs which may be seen to change as a household passes through particular life cycle stages (certain critical stages can be identified where the household is expanding or contracting in size. Propensity for moving is normally greatest at these stages; Simmons, 1968; Sabagh et. al., 1968).

2) duration of residence - a variable which summarises the past mobility behaviour of households, and a household attribute which has been advanced as a contributing factor in subsequent mobility activity (see Goldstein, 1956, 1964). Conceptual underpinning for a link between past and future residential mobility behaviour has been provided by Van Arsdol et. al., (1968) in

TABLE 6.12

STEPWISE REGRESSION ANALYSIS
OF MOVER-STAYER INDICANTS

MODEL 1 : THREE GROUP CASE
(EXPECTED STAYER, UNEXPECTED STAYER, MOVER)

STEP	VARIABLE ENTERED	R	PARTIAL CORRELATION OF REMAINING PREDICTORS WITH DEPENDENT	VARIABLE
1	STAGE IN FAMILY LIFE CYCLE	0.42		
2	PREVIOUS TENURE	0.49	AGE OF HEAD	0.04
3	OCCUPATION STATUS OF HEAD	0.53	INCOME OF HEAD	-0.03
4	DURATION OF RESIDENCE	0.55	YEARS RESIDENCE	-0.02
5	TOTAL EVENTS	0.56		
6	SATISFACTION LEVEL	0.57		

MODEL 2 : TWO GROUP CASE
(EXPECTED & UNEXPECTED STAYERS, MOVER)

STEP	VARIABLE ENTERED	R	PARTIAL CORRELATION OF REMAINING PREDICTORS WITH DEPENDENT	VARIABLE
1	PREVIOUS TENURE	0.39		
2	DURATION OF RESIDENCE	0.45	AGE OF HEAD	0.02
3	OCCUPATION OF HEAD	0.49	INCOME OF HEAD	-0.03
4	STAGE IN FAMILY LIFE CYCLE	0.50	YEARS RESIDENCE	-0.03
5	TOTAL EVENTS	0.51		
6	SATISFACTION LEVEL	0.52		

terms of self consistency and dissonance, and more recently, by Morrison (1971) in terms of 'duration-of-stay' effect.

3) previous tenure - is a variable which is consistently linked with residential mobility activity, and in the present study has emerged as a principal determinant of the mover-stayer outcome. The economic advantage (perceived or real) of homeownership is one factor underlying residential movement from rental to ownership accommodation (Katona and Mueller, 1962; Shelton, 1968). An equally important factor is that homeownership is strongly ingrained in the national ethos and is financially encouraged by government policies[22].

4) the occupation of the head of the household is normally considered a major factor in internal rather than intra-urban migration (Pihlblad and Gregory, 1957; Beshers and Nishiura, 1961; Bogue, 1969; de Castro Lopo, 1975). But for particular periods, and for certain centres, the housing and finance markets may be such that the normal range of housing transactions are not concluded. Available evidence suggests that this was the case in Christchurch, at least for the first six to eight months of 1974[23]. The escalating price of property and the tightness of finance combined to exclude certain groups (particularly the lower income and occupational status groups - see Table 6.13) from the marketplace. This fact is reflected in the appearance of the variable 'occupational status' in the regression equation.

The variables 'total events' and 'satisfaction level', which have been independently examined as explanatory factors in a previous section, make little contribution to an overall explanation of mobility outcome when bracketed with the variables listed above. The reason for this, and the fact that no further variables were added to the model equation is apparent from an inspection of the intercorrelations in Table 6.13. Zero-order correlations between the dependent variable(s) and the individual predictors are moderate to low. This need not result in a multivariate regression or correlation model with a low level of explained variation (as in the present case) if correlations among the set of predictor variables are near-zero, thereby ensuring independent additive contributions to the 'explanation'. It is clear that such is not the case.

The variables found to contribute significantly to overall explanation in the two stepwise regression models were retained for the discriminant analysis. Discriminant analysis based on linear discriminant functions identifies the dimensions of classification expressed by the discriminant functions in the same manner that component analysis identifies the dimensions of variability expressed by principal components. Focusing first on Model 1 (Table 6.14) reveals that 97 percent of the intra-group variability (or discriminatory power of the classification) is concentrated in the first linear discriminant function. No significant discrimination is afforded by the second discriminant function (3 percent explained variance, X^2 = 4.9, d.f. = 5). The nature of each discriminant function can be determined by examining the discriminant weights and the correlation co-efficients between the variables and the discriminant functions (discriminant loadings). Both Veldman (1967) and Tatsuoka (1970) favour interpretation in terms of discriminant loadings, which are analogous to the loadings in factor analysis[25]. The loadings on the principal discriminant function in Model 1 suggests that all six variables are making significant contribution to mover-stayer separation. When expected and unexpected stayers are combined as a single group (Model 2), the single discriminant function which results[26] is seen to exhibit a structure similar

TABLE 6.13

INTERCORRELATIONS AMONG HOUSEHOLD
CHARACTERISTICS AND MOBILITY OUTCOME

VARIABLE										
TOTAL EVENTS	100									
PREVIOUS TENURE	36	100								
AGE OF HEAD	-39	-43	100							
LIFE CYCLE STAGE	-36	-40	78	100						
DURATION OF RESIDENCE	-35	-35	58	49	100					
OCCUPATION (HEAD)	-06	03	03	10	05	100				
INCOME (HEAD)	15	07	-25	-33	-23	-38	100			
YEARS RESIDENCE	-34	-40	59	48	70	07	-22	100		
SATISFACTION LEVEL	26	23	-36	-36	-32	04	20	-24	100	
MOVER-STAYER 1 *	34	41	-37	-42	-37	-20	18	-35	26	100
MOVER-STAYER 2 *	30	39	-34	-37	-36	-17	15	-34	24	100

* MOVER-STAYER 1 : 3 GROUP CASE
MOVER-STAYER 2 : 2 GROUP CASE

TABLE 6.14

MOVER-STAYER DISCRIMINANT MODELS

INDICANTS	MODEL 1 I	MODEL 1 II	MODEL 2 I	MODEL 3 I
	DISCRIMINANT FUNCTIONS			
TOTAL EVENTS	-20* (-60)**	20 (16)	-17 (-58)	-17 (-61)
PREVIOUS TENURE	-73 (-73)	-54 (-32)	-80 (-76)	-77 (-75)
STAGE IN FAMILY LIFE CYCLE	30 (75)	-48 (-33)	23 (72)	29 (75)
DURATION OF RESIDENCE	03 (65)	09 (51)	04 (69)	04 (69)
OCCUPATION STATUS OF HEAD	28 (36)	-11 (-22)	26 (34)	27 (36)
SATISFACTION LEVEL	-51 (-47)	65 (23)	-46 (-46)	-47 (-47)
PERCENT VARIANCE EXPLAINED	97	3	100	100
CHI-SQUARE	142.8	4.9	114.5	136.2
DEGREES OF FREEDOM	7	5	6	6
SIGNIFICANCE LEVEL	<.00001	<.58	<.00001	<.00001
WILKS LAMBDA	0.67		0.74	0.67
F-RATIO	13.5		22.2	27.8
DEGREES OF FREEDOM	12,738		6,370	6,328

* DISCRIMINANT WEIGHTS
** DISCRIMINANT LOADINGS

MODEL 1 : 3 GROUP MODEL(EXPECTED STAYERS,UNEXPECTED STAYERS, MOVERS)

MODEL 2 : 2 GROUP MODEL(EXPECTED AND UNEXPECTED STAYERS, MOVERS)

MODEL 3 : 2 GROUP MODEL(EXPECTED STAYERS, MOVERS) to that of the three-group model. A further model, which considers only expected movers and expected stayers (Model 3) continues to display a similar pattern of discriminant loadings, suggesting a reasonably high level of stability among the variables as regards their performance as discriminators of household mover-stayer activity.

The success of the variable set in predicting group membership for different mover-stayer schemas, does appear to vary, however[27] (see Table 6.15). In the first mover-stayer model three groups were involved. If we had been aware of all the factors involved in the decision to move or stay, and had been able to properly measure them then we could have anticipated 100 percent correct classification. As it stands, the mobility outcome of only 62 percent of households was correctly predicted by the model equation (as opposed to 33 percent by chance). The greatest number of misallocations involved the 'unexpected stayers' group: 23 out of 42 households (55 percent) were placed, on the basis of their profiles on the six discriminants, into the 'mover' group.

Two group models based on actual behaviour (Model 2) and planned behaviour (Model 3) do not improve the ratio between percentage correct classifications obtained via the discriminant model or via chance (now 50 percent). A level of correct allocation in the order of 80 percent suggests that a number of important factors connected with the outcome of the residential mobility decision have been identified, quantified and integrated within the framework of an explanatory model.

Further attention needs to be directed to the way in which an outcome such as in situ adjustment (unexpected stayer) can be more successfully modelled. The binary mover-stayer model has emerged as a robust framework for studying mobility outcome,

TABLE 6.15

SUCCESS OF DISCRIMINANT MODELS
IN SEPARATING MOVER AND STAYER HOUSEHOLDS

MODEL 1

PREDICTED GROUP	ACTUAL GROUP 1	2	3	
1	130	13	20	163
2	19	6	17	42
3	51	23	98	172
	200	42	135	377

1: EXPECTED STAYER S
2: UNEXPECTED STAY ERS
3: MOVERS

CORRECT CLASSIFICATIONS: 62%

MODEL 2

PREDICTED GROUP	ACTUAL GROUP 1	2	
1	182	30	212
2	60	105	165
	242	135	377

1: EXPECTED & UNEX PECTED STAYERS
2: MOVERS

CORRECT CLASSIFICATIONS: 76%

MODEL 3

PREDICTED GROUP	ACTUAL GROUP 1	2	
1	157	28	185
2	43	107	150
	200	135	335

1: EXPECTED STAYER S
2: MOVERS

CORRECT CLASSIFICATIONS: 79%

yet even here there is a need for the isolation of additional discriminatory variables which can raise its classificatory power.

To this end, variable profiles for households assigned to the four 'hit' and 'miss' outcomes from Model 3 were examined for the presence of marked variations (Table 6.16). Clear differences on most variables are expected for the two groups where households were successfully allocated to a priori classes (i.e. groups 1 and 4). This was the case for all variables listed in the table (there were several which produced no difference across the four groups). An interesting feature of Table 6.16 is the manner in which allegiances between groups shift across certain variables. For instance, Group 1 (expected stayers correctly allocated) is distinct from all others on two indicants: an absence of 'events' (66 percent of households) and low occupational status (54 percent). Group 4 (expected movers correctly allocated) in contrast, is readily separated from the remaining three groups on the following four indicants: resident in a single family dwelling (64 percent), in a dwelling with more than two bedrooms (43 percent), a head of household less than 30 years of age (49 percent) and a gross weekly income over $100 (60 percent).

Of greater interest, perhaps, is the manner in which the remaining indicants serve to orient group separation. In all cases, Groups 1 and 3 (expected stayers correctly allocated, expected movers incorrectly allocated) are set apart from Groups 2 and 4 (expected stayers incorrectly allocated, expected movers correctly allocated). One indicator involved in this separation is 'increase in household size'. Low percentages for households in Groups 1 and 3 indicate that a stable household size (rather than household size per se)

TABLE 6.16

SELECTED HOUSEHOLD PROFILES OF MOVER-STAYER GROUPS AT TIME OF SURVEY(JAN-FEB 1974)

HOUSEHOLD CHARACTERISTIC	GROUPS *			
	1	2	3	4
INCREASE IN HHOLD SIZE(BIRTH ETC.)	6	40	11	40
ABSENCE OF 'EVENTS'	66	16	36	21
RESIDENT IN SINGLE FAMILY DWELLING	96	95	100	64
OWNER OCCUPIER	76	35	86	21
MORE THAN TWO BEDROOMS	71	88	79	43
HEAD OVER 30 YEARS OF AGE	6	30	14	49
CHILD BEARING STAGE OF FAMILY CYCLE	5	33	7	38
AVE. DURATION OF RESIDENCE <5.0 YRS	27	84	54	88
LOW OCCUPATIONAL STATUS (HEAD)	54	26	39	16
GROSS WEEKLY INCOME >$100 (HEAD)	32	47	36	60
< 5 YRS RESIDENCE AT PRESENT LOC'N	26	79	43	87
SUB-TOTAL N	157	43	28	107

ALL TABULATED FIGURES ARE PERCENTAGES OF SUB-TOTAL N

* 1 : EXPECTED STAYERS CORRECTLY ALLOCATED
2 : EXPECTED STAYERS INCORRECTLY ALLOCATED
3 : EXPECTED MOVERS INCORRECTLY ALLOCATED
4 : EXPECTED MOVERS CORRECTLY ALLOCATED

considerably dampens the propensity for residential movement. Other household attributes which appear to exert a similar influence are: tenure status (high percentages of owner occupancy are characteristic of households who express no desire for residential movement and of households who initially plan to move but do not actualise that plan); life cycle stage (only 5 percent and 7 percent of households in Groups 1 and 3 were classed as being in the child-bearing stage - a family life cycle stage during which a household normally experiences increasing demand for space and the 'environment' of single family, ownership property); and duration of residence (average duration of residence and length of residence at previous location were both considerably lower for Groups 2 and 4 - the movers).

Rather than pointing the way to additional variables which serve as useful discriminators for mobility outcome, the profiles outlined above merely assist in clarifying some of the major differences between mover and stayer groups - when conceived in a binary framework. A successful extension to a three or four-group model as outlined in Figure 6.4 would appear to require, among other things, a detailed second interview, which could probe for factors leading to in situ adjustment (e.g. addition of space to existing dwelling, reduction in dissatisfaction level, etc.) or unexpected movement (e.g. eviction, job transfer, etc.).

The models established in the present section have, however, proved themselves well-suited to explaining and predicting either a move or stay outcome for a group of urban residents. In the section which follows, we consider, relatively briefly, a second outcome of the residential location process: the choice of residence.

A MODEL OF RESIDENCE CHOICE

Up to the present point, the analysis of mobility behaviour has attempted to identify factors which explain mover-stayer behaviour. For households who undertook an intra-urban move within Christchurch during 1974 two further mobility outcomes remain to be explained: the type of residence chosen for relocation, and its location within the city.

There are a number of ways to represent the outcome of residence choice: as a tenure outcome (own or buy vs. rent), as a dwelling type outcome (house vs. flat), and as an expenditure outcome. The tenure and dwelling type outcomes have both been modelled with some success by Kaiser et. al., (1971), Silver (1970) and Goldstein (1973). Since the present study is concerned with moves to ownership property, the residence choice model formulated in the present section will attempt to identify and evaluate the key determinants of housing expenditure.

The demand for housing (as measured by housing expenditure) has been the subject of numerous studies by urban economists (see de Leeuw, 1971, for a review). Most of these studies, however, have focused on aggregate housing demand, and it is now recognised that many relevant differences among individual households ought to be considered in conjunction with the conventional economic variables[28] in studying the demand for housing.

Model Formulation

With the demand for housing being estimated as a function of household attributes, the statistical model employed was multiple linear regression, the general form of the equations being given as:

$$D = a_1 x_1 + a_2 x_2 \ldots + a_n x_n$$

where D represents a household's level of demand for housing

x_i is a set of household attributes

a_i represent the contribution of the corresponding household characteristics (X_i) to an estimate of housing expenditure.

The dependent variable (D) is given as the average of the price range within which the mover household expected to operate when searching for suitable residential property. The independent variables selected for analysis are:

1) current gross weekly income of head: a number of studies (Reid, 1962; Muth, 1968) suggest that the demand for housing is income elastic. The hypothesis is that as income rises, the household spends proportionately more of its increased income on purchasing larger and/or better quality housing (this argument is developed further in Goodall, 1972, Chapter 6).

2) loan assistance: households were requested to specify the proportion of the expected cost of the property required to be met through loans. The measure is a corollary of Malone's (1966) down payment index, and it provides an indication of a household's available assets prior to its entry into the housing market.

3) housing tenure: referred to in a number of housing demand studies (e.g. Lee, 1963) as 'initial homeownership', provides an indication of a household's achieved stock level. Three classes of tenure are recognised: ownership, mortgage and rental.

4) family status attributes such as age of head and household size, have been advanced as determinants of housing expenditure: household size as an indicant of the space requirements of the household; age of head as an indicant of accumulated

capital (Silver, 1970) and life-cycle related housing needs.

5) social status attributes such as the educational and occupational characteristics of a household are seen to be important in their effect on its behaviour within the housing market in both the long and the short run - over and above their connection with earning capacity (Apps, 1973a, 1973b, 1974). In the short run, the social status attributes are likely to affect both the household's knowledge of the market and its reaction to it, and in the long run its preferences for different types, styles and quality of housing.

6) household residential preferences emerge as significant components in a number of residential location studies (Flowerdew, 1973; Michelson, 1966; Menchik, 1972; Herbert, 1973; Williams, 1971; Weiss et. al., 1973; Weiss, Kenney and Steffens, 1966). Among several approaches available for eliciting and analysing household preferences for dwelling and neighbourhood features (open ended questions and frequency ranking; scaling responses to a set of predetermined statements; see Johnston, 1973d), the present study chose to identify the principal areas of housing preference via component analysis of household responses to a series of questions concerned with dwelling requirements (see Part 5 of Questionnaire, Appendix VI.1). Three dimensions summarise the major patterns of co-variation among the individual indicants: size of dwelling, condition of dwelling and dwelling type (see Table 6.17). Variation in preferences along these dimensions by the group of 135 mover households is likely to be reflected in concomitant variation in expected capital outlay for vacant property.

The zero-order correlations presented in Table 6.18 (variable set 1) reveal that a moderate level of association

TABLE 6.17

HOUSEHOLD RESIDENTIAL PREFERENCES *

VARIABLES	COMPONENTS 1.	2.	3.	H^2
NUMBER OF BEDROOMS	88			79
SIZE OF HOUSE	84			75
AGE OF HOUSE		-86		74
BUILDING MATERIAL		58		71
CONDITION		82		68
SECTION SIZE			-81	68
DWELLING TYPE			75	57
CUM. % VARIATION	25	50	71	
EIGENVALUE	2.1	1.7	1.1	

* VARIMAX ROTATED PCA
LOADINGS >50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. SIZE OF DWELLING
2. CONDITION OF DWELLING
3. DWELLING TYPE

TABLE 6.18

INTERCORRELATION ANALYSES AMONG
HOUSING EXPENDITURE INDICANTS
VARIABLE SET 1

VARIABLE												
PREVIOUS TENURE	100											
HOUSEHOLD SIZE	-14	100										
AGE OF HEAD	-38	12	100									
OCCUPATION (HEAD)	15	-02	-02	100								
WORKING SPOUSE	09	02	-07	03	100							
INCOME(HEAD)	02	13	-09	-21	05	100						
EDUCATION HEAD	02	01	10	47	03	-25	100					
LOAN FINANCE	50	-13	-01	15	12	10	-16	100				
PREF:DWG SIZE	20	12	-05	09	01	09	-10	13	100			
PREF:DWG CONDITION	-11	47	-03	-24	03	29	-28	-06	00	100		
PREF:DWG TYPE	08	-06	19	11	-18	-23	03	-17	-01	04	100	
EXPENDITURE	-31	31	18	-36	-01	46	-31	-29	-12	43	-20	100

VARIABLE SET 2

LOAN FINANCE	100							
LIFE CYCLE FACTOR	-70	100						
HHOLD SIZE FACTOR	-19	30	100					
SES FACTOR	00	16	01	100				
PREF:DWG SIZE	13	-13	09	01	100			
PREF:DWG CONDIT.	-06	08	49	33	00	100		
PREF:DWG TYPE	-17	13	-08	-12	-01	04	100	
EXPENDITURE	-29	31	39	47	-12	43	-20	100

holds between expected expenditure level and several household attributes. No evidence for the existence of multicollinearity emerges from an inspection of the matrix, but to ensure statistical independence among the household expenditure indicants prior to regression analyses, the three dimensions of household structure (see Table 6.2) were used to summarise several of the indicants listed above (variable set 2, Table 6.18).

Stepwise regression analysis undertaken on the eleven housing expenditure variables yielded an equation which retained eight indicants (see Table 6.19, Model 1). The amount of finance required to be met via loans, the income available for servicing the loan and the family space requirements as determined by the number of people in the household continue to emerge as principal determinants of housing expenditure. As well, the present study points to the additional impact made by household preferences for certain dwelling features on an overall level of prospective expenditure on property.

These findings are merely reinforced by Model 2, where household socio-economic status explains more variance in housing expenditure than any other household variable. In contrast to the mover-stayer models developed earlier, there is a marked absence in the residence-choice model (when assessed in relation to anticipated expenditure by home purchasers) of life cycle related attributes.

It is possible that in the same manner as households are allocated to residences primarily in relation to their ability to pay, so might it be that locations are similarly allocated among mover households. But in situations where quivalent housing is available in different types of neighbourhood and at various points within the city, what additional factors must be considered when attempting to explain and predict the locational choices of intra-urban migrants? It is to this question that we now turn.

TABLE 6.19

STEPWISE REGRESSION ANALYSIS OF HOUSING EXPENDITURE INDICANTS

MODEL 1

STEP	VARIABLE ENTERED	R	COEFFIC	PARTIAL CORRELATION OF REMAINING PREDICTORS WITH DEPENDENT VARIABLE	
1	INCOME(HEAD)	0.46	2.15		
2	LOAN FINANCE	0.57	-1.68	AGE(HEAD)	0.05
3	PREF:DWG CONDIT.	0.62	0.13	OCCUPATION(HEAD)	-0.08
4	EDUCATION(HEAD)	0.66	-0.69	WORKING SPOUSE	-0.02
5	PREF:DWG TYPE	0.69	-0.11		
6	PREF:DWG SIZE	0.70	-0.11		
7	HOUSEHOLD SIZE	0.71	0.73		
8	PREVIOUS TENURE	0.72	-0.83		
	INTERCEPT		28.14		

MODEL 2

STEP	VARIABLE ENTERED	R	COEFFIC	PARTIAL CORRELATION OF REMAINING PREDICTORS WITH DEPENDENT VARIABLE	
1	SES FACTOR	0.47	0.31		
2	HHOLD SIZE FACTOR	0.60	0.19	LIFE CYCLE FACTOR	-0.01
3	LOAN FINANCE	0.64	-1.44		
4	PREF:DWG TYPE	0.66	-0.13		
5	PREF:DWG CONDIT.	0.68	0.13		
6	PREF:DWG SIZE	0.69	-0.09		
	INTERCEPT		7.51		

NOTES

1 That is, models based on the entire sample of households; disaggregation is normally undertaken to assess model performance for particular types of household (e.g. high income; elderly households, etc.).

2 1800 questionnaires were delivered to randomly selected households. This figure represents approximately 2.5 percent of Christchurch's total number of households.

3 The sample of 411 'expected stayers' was reduced (by random exclusion) to 200 to retain a measure of balance with the mover group (N = 135).

4 Stated occupations were scaled on a 6-point status rating developed by Davis (1974) for New Zealand occupations (based on Congalton, 1969).

5 Profiles of household characteristics for the Christchurch Urban Area (in 1971) can be found in Supplement No. 8, Canterbury Statistical Area, 1971 Census of Population and Dwellings, Department of Statistics, Wellington, February 1974.

6 Brown and Moore's (1970) model represents a synthesis of several concepts contained in articles by Chapin (1968: two-stage migration process), Wolpert (1965, 1966: stress, strain, place utility) and Rossi (1955: information sources), among others.

7 Goodman (1961) has argued that the problem with the binary mover-stayer model is that it exaggerates the similarity within the mover and stayer groups. Lack of within-group homogeneity could be expected to reduce the explanatory and predictive power of the resultant models.

8 The findings of Van Arsdol et. al., (1968) that retrospective, subsequent, planned and choice residential movements are not necessarily congruent for individual households is relevant here. Pickvance (1974) has also found that models of desired and expected mobility (analogous to Van Arsdol et. al.'s choice and planned mobility) have different structures.

Life cycle and tenure had a crucial role in determining both desired and expected mobility while the income variable only had a direct effect on expected mobility.

9 The dependent variable in a retrospective mobility model is normally given as a retrospective mobility rate:

$$RMR = \frac{M}{Y}$$

where M is the number of residence-shifts undertaken during a specified time period (e.g. since marriage, or since leaving the parental home),
Y is the duration of the specified time period.
Average duration of residence is the reciprocal of the retrospective mobility rate.

10 Forty percent of households in the present survey offered 'homeownership' as their principal reason for moving. This meant that only 6 percent of renters gave some reason other than ownership when asked why they were considering a move.

11 Description of Variables:

a) Tenure Status: binary
b) Age of Head: continuous-categorised
c) Life Cycle Stage: ordinal (after Sabagh et. al., 1968, p.90)
d) Occupational Status: ordinal (after Davis, 1974)
e) Income: continuous-categorised
f) Education: ordinal
g) Years Residence: continuous
h) Average Duration of Residence: continuous (see Note 9).

12 Within the period: January 1974 - December 1974 (see Question 2, Part 1, Household Residential Mobility Survey, Appendix VI.1).

13 Given the complexity of the 'satisfaction' concept (see Harvey, 1969, p.120), problems of measurement are merely compounded by the addition of an equally complex concept: 'stress' (see Horvath, 1959); particularly if the latter concept does not assist in our explanation or prediction of the phenomenon being studied.

14 This concept is essentially the same as the stress-threshold concept used by Wolpert (1966) and Brown and Moore (1970).

15 It could also be argued that a household would experience a high level (perhaps the highest level) of stress when it is considered that there was NO opportunity for obtaining a better residential environment elsewhere. The 'unconstrained opportunity' approach adopted by Clark and Cadwallader (1973) would appear to be better suited to a model of desired rather than actual residential mobility.

16 There are a number of studies (e.g. Crothers, 1970) which index a household's level of satisfaction by its stated desire for future residential movement. Such a measure is extremely crude, and would introduce circularity of argument if adopted in the present study.

17 When the distribution of responses to the satisfaction-dissatisfaction items are examined (see Appendix VI.2) it is evident that most households are reasonably well satisfied with their housing (a similar finding to that of Butler et. al., 1969). The extent to which mover and stayer groups differ in their responses to the 34 satisfaction-dissatisfaction items is discussed later in the chapter.

18 Butler et. al. (1969, pp.19-20) reduced 41 satisfaction-related indices to 4 major components: neighbourhood satisfaction (physical appearance and status), satisfaction with accessibility, with interior of dwelling unit (particularly space) and satisfaction with neighbourhood services. Onibokun's (1973) analysis of household responses on 29 variables yielded 6 components: physical congestion and external overcrowding, recreation and open space, public opinion (reputation), public services, schools, and public transport/accessibility.

19 A factor index is distinct from a factor score since only those variables which load highly on a particular dimension are employed in the computation of the factor index (given as the average of an individual's original scores on the relevant variables of a particular dimension).

20 The numerical values assigned to the mover-stayer groups for correlation analyses were:

a) Two group case: expected and unexpected stayers, 1;
movers, 2.

b) Three group case: expected stayers, 1;
unexpected stayers, 2;
movers, 3.

Refer also to the Tau C and Gamma values listed in Table 6.8. Initially it had been envisaged that the performance of a four-group mover-stayer model would be tested in the present study. Unfortunately, the task of contacting over 400 'stayer' households to determine whether they had, in fact, stayed, was beyond the time scale for the fieldwork phase of the project.

21 Multiple discriminant analysis is employed in studies where it is possible to establish the a priori existence of particular groups (e.g. growing, stable or declining urban communities, King, 1967; mover-stayer groupings). The purpose of the analysis is then to distinguish the groups from one another on the basis of their variable profiles.

One or more of the following steps are normally undertaken:

1) determining whether the groups differ significantly from one another,
2) if the groups do differ, then it is usual to determine the minimum number of dimensions (termed linear discriminant functions) required to best separate the groups on the basis of a given variable set. This also permits derivation of the relationship between the variables and the discriminant function (analogous to the loadings of variables on components in principal components analysis; see Casetti, 1964).
3) the linear discriminant function can then be employed in the assignment of new individuals to one of the established groups.

An excellent treatment of discriminant analysis can be found in Tatsuoka, 1971 (and may be supplemented by Nunnally, 1967; Cooley and Lohnes, 1962; Tiedeman, 1951). The computer program employed for multiple discriminant analysis is due to Veldman (1967).

22 Approximately 75 percent of all dwellings within Christchurch Urban Area in 1971 were owner-occupied (1971 Census of Population and Dwellings, Supplement No. 8, p.62).

23 See The Report of the Valuation Department (for the year ended 31 March, 1975), especially pages 5-7.

24 The sign reversal of the correlations income/mobility and occupational status/mobility is a function of coding.

25 Loadings are favoured in interpretation because the raw score weights are influenced by the measurement scales of the 6 predictor variables and hence do not accurately reflect the relative importance of each variable in differentiating among the groups (a more detailed explanation is found in Tatsuoka, 1970, pp. 51-52).

26 The number of discriminant functions which result from the application of multiple discriminant analysis are G-1 (where G is the number of original groups) or V (number of variables - but only when V < G); see Cooley and Lohnes (1971, p.244).

27 The method which Cooley and Lohnes (1962) advocate for predicting group membership, and the one adopted in the present study essentially involves comparing the score profile for an individual household with the characteristics of an already established group. Probabilities of the individual's joining each of the groups in the classification are computed and the individual is assigned to that group for which his probability of group membership is highest.

28 Usually one of several measures of household income (e.g. permanent income, current income; see Silver, 1970, pp. 90-91).

CHAPTER SEVEN

LOCATIONAL CHOICE MODELS

Given that a household has made a decision to move, and has subsequently formulated a price range for residence choice, a final decision for the mover household is one which concerns its choice of location within the urban area. The task of the present chapter is to explain and predict this choice, given a number of alternative locations within the city[1] to which the household could move. An explanatory model is based on the locational choice behaviour of a randomly selected sample of households who changed residence within Christchurch during 1974. The predictive efficiency of this model is tested for a separate group of intra-urban movers.

In addition to the identification of variables necessary for an explanation and prediction of locational choice, important features of the present chapter include:

1) an examination of the influence of vacancy structure and pattern on model performance;
2) an assessment of the influence of area homogeneity on the explanatory and predictive power of a location allocation model; and
3) an investigation of the role of an area's location within the city system in locational choice modelling.

GUIDING PRINCIPLES FOR A MODEL OF LOCATIONAL CHOICE

The principle which has guided the formulation of locational choice models in the present study is one where household locational choice behaviour is regarded as the outcome of the interaction between two basic factors: the behavioural propensities of the individuals; and the areal constraints confronting those individuals (after Cox, 1974). The former are seen as the mechanisms which govern individual locational behaviour irrespective of the set of environmental constraints faced by the individual. One such propensity is the preference that particular households hold for access to shops, workplace, etc; other preference sets may relate to level of neighbourhood prestige, dwelling density and so on. Other behavioural propensities might refer to the impact of differential resources on locational choices: those households with greater resources at their disposal tend to bid more for attractive locations than those with fewer resources, so that there is a tendency for the wealthier to acquire more attractive locations, wherever they might be, and the poorer to end up in the less attractive locations.

Locational choices are, however, made with respect to a particular configuration of areal constraints: for example, the distribution of certain types of housing the location of major employment centres, the pattern of social areas and the distribution of vacancies. The signficance of such environmental constraints rests with the fact that in order to satisfy their preferences for various types of neighbourhood and levels of relative accessibility within the city system, households need to move to particular locations. It is necessary, therefore, that a model of locational choice be concerned with how households' attempt to satisfy their preferences within a city's existing areal constraints.

The present formulation represents a development from the statements by Horton and Reynolds (1971) and Clark (1972), concerning behaviour in space. It also recognises the contributions of several housing and mobility studies, in particular, Foote et. al., (1960: choices and constraints), Sabagh et. al., (1968: push-pull factors and frictional constraints), Moriarty (1970: 'economic competition' and 'social choice' hypotheses) and Pahl (1970: constraints in access to housing). What is lacking in the abovementioned studies is a clear specification of a model-framework which links individual or household locational choice behaviour with the residential system within which the relocation activity is undertaken.

In assessing the contribution of urban ecological approaches to residential location modelling, Senior (1973) correctly points to their clarification of our knowledge concerning urban residential structure. He also indicates that findings from factor ecological studies could be suggestive of hypotheses of residential location behaviour which may be usefully incorporated into more analytically-oriented model designs.

Conceptual Basis for an Integrated Model of Locational Choice

It is Berry and Rees (1969; see also Rees, 1970) in fact, who provide the conceptual basis for an integrated model of residential location by specifying how the principal findings from factor ecological analyses can be linked with individual household data. While several authors (Johnston, 1971, p.343; Herbert, 1972, p.263; Speare et. al., 1975, p.102) have commented upon its utility as a framework for a comprehensive model of residential location little or no analytical development has been achieved.

Berry and Rees' (1969) schema (represented with slight modification in Figure 7.1) of residence and locational choice can be summarised as follows:

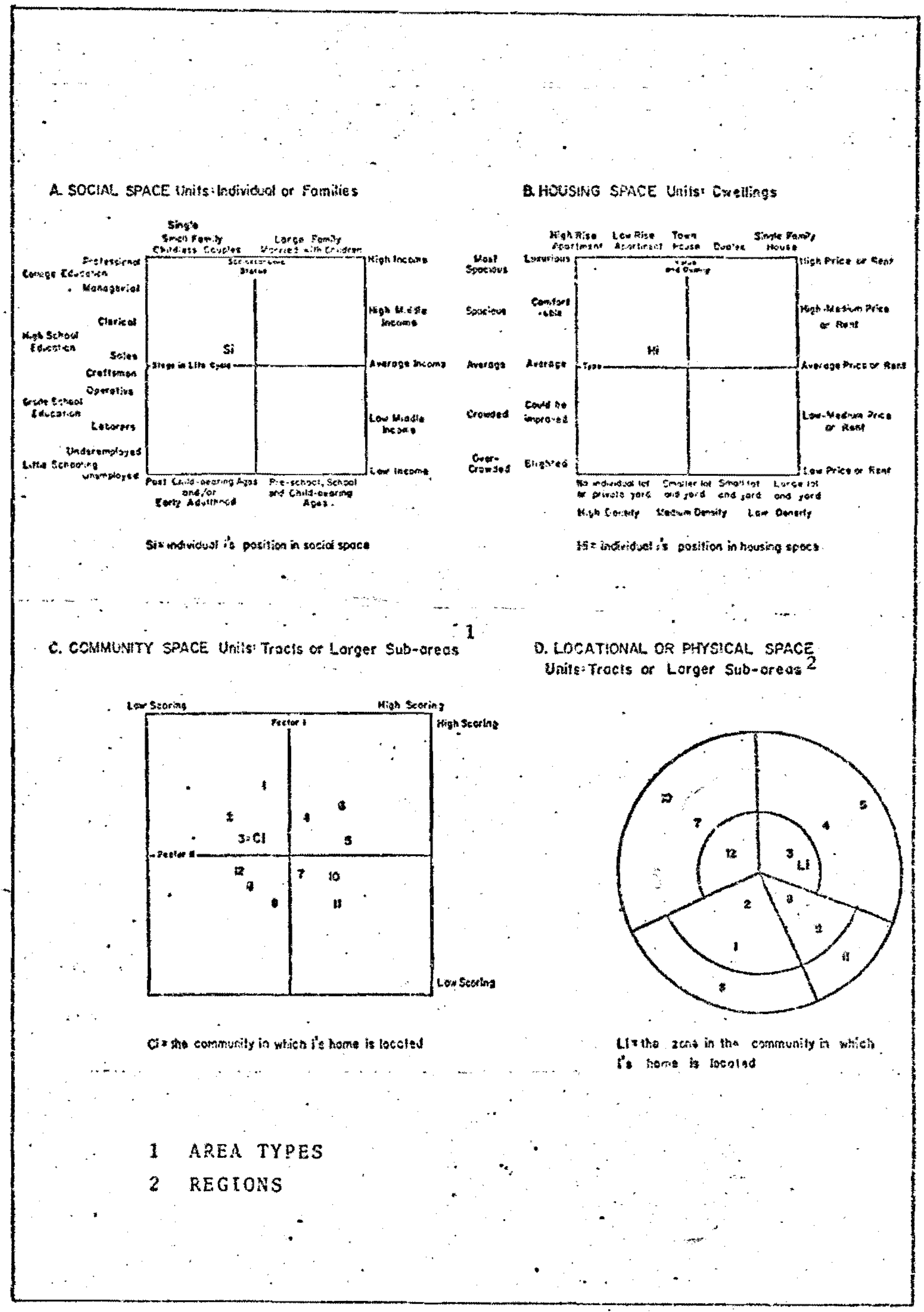


FIGURE 7.1 : THE RESIDENTIAL LOCATION PROCESS (After Rees, 1970)

The individual or family occupies a position (Si) in social space, determined by its economic and family status. Assuming that a household's socio-economic status determines its ability to pay for a higher priced dwelling, and that life cycle stage influences the preferred dwelling unit type, then the household can match its position in social space with that of a dwelling located in an analogous position (Hi) in housing space. If one then assumes that individuals with similar characteristics live in the same area a community space will result, and all individuals who stand at position Si in social space and Hi in housing space will reside in community type (Ci) in community space. Finally, the various communities can be assigned to a location in the city's physical space (e.g. zones and sectors if a spatial geometry is required; sub-urban region - viz. Figure 1.1 - if an ecological approach is followed).

These associations can be expressed symbolically as:

$$Hi = f(Si) \qquad \ldots\ldots\ (1)$$

$$Ci = f(Hi, Si) \qquad \ldots\ldots\ (2)$$

$$Lx = f(Ci, Xi);\ Lx > Ci \qquad \ldots\ldots\ (3)$$

where

Hi = the position of the i^{th} house in housing space

Si = the position of the i^{th} house in social space

Xi = the position of the i^{th} household with respect to locational preference

Ci = the position of the i^{th} residential district in community space (an aspatial designation - see Chapters 1 and 5)

Lx = the presence of the i^{th} household in a sub-urban residential region (representing a unique location within the city - again, see Chapters 1 and 5).

Yeates (1972b) has examined the relationship between housing space and social space and between housing and social space and community space (equations 1 and 2). He confirms a certain level of congruence between the linked models. His study represents a static examination of the congruence between a household, its housing and its location (in an area type rather than a suburban region), and as such tends to ignore the more important, dynamic, elements in the Berry and Rees formulation. The latter's concern, in contrast, is directed towards the identification of mechanisms or factors which underly a household's choice of residence and location:

> *... the choice of house and community type is only one part of the complete residential location decision ... The housing consumer is also faced with the problem of* locating *his residence. This involves attitudes towards the journey to work, for the time and cost of commuting have to be traded off against the relative benefits of living in alternative communities that meet, within budgetary constraints, family needs. (Berry and Rees, 1969, p.462).*

The locational choice models outlined in this chapter take the Berry and Rees schema as a starting point for their conceptual development. Extensions are required in the following areas and for a number of reasons:

1) The generalisations regarding individual housing preferences and constraints, such as those contained in the above quotation, require clearer specification. This will follow as a matter of course when consideration is being given to variables which are to enter the model equations for location allocation.

2) The two-dimensional classification of residential areas employed by Berry and Rees provides only a partial representation (albeit a readily understandable one) of a city's residential structure within which mover households must undertake locational choice. The strucutre of the housing

market should also be taken into account when classifying residential sub-areas prior to any modelling of locational choice behaviour. Not only will this serve to reduce the number of sub-areas with similar population and housing profiles (i.e. reduce the potential for mis-allocation), but it will also allow variables relating to household preferences for particular housing environments to be incorporated into locational choice models.

3) The nature of the models developed in this chapter depend, for a high level of explanation (and ultimately prediction) on the degree of mix among population and housing characteristics in the set of potential destination areas. It is hypothesised that the greater the heterogeneity of an area, the greater is the potential for households with quite different residential needs to relocate within the same sub-area. The data matrix implicit in Berry and Rees' identification of 'community space' is concerned solely with exploring inter-area variations, and takes no account of within area differences - a situation which is akin to investigations of differences between means that take no account of their respective variances (see Newton and Johnston, 1976). In extending areal classifications in order to incorporate patterns of both inter and intra-area variation into the locational choice model it is possible not only to approximate more closely the total social environment of the residential areas of the city, but also increase the probability for successful allocation of mover households among these areas.

4) The elegant simplicity of the Berry and Rees' schema requires that a very important element in the residential location process, namely, the spatial characteristics of the vacancy market, is absent from their formulation. Yet the reality

of the urban housing market is such that for certain periods of time particular types of housing may not be represented on the market. Area-to-area variations in vacancy rate are also well documented. The importance of this point intensifies when an attempt is made to model household locational choice on the basis of stated preferences for type of neighbours, type of housing environment and access to certain activity modes. The structure of the vacancy market during any search period may be such that a number of household preferences cannot, in fact, be actualised. Therefore, a locational choice equation which attempts to allocate households to areas, primarily as a function of stated preferences, would seem to require the entry of a measure of vacancy pattern - as a constraint - into the model.

5) A useful contribution by Berry and Rees is their distinction between residence location in community space (an aspatial position) and location of residence in physical space:

> *From a range of possible communities found in the same zone of community space, one dwelling in one community is selected on the basis of proximity to job location (if this is a constraint) or on the basis of other important neighbourhood characteristics, thus fixing the choices in real geographic or physical space. (Berry and Rees, 1969, p. 463.)*

The classifications and regionalisations undertaken in Chapter 5 mirror this distinction and provide the basis for establishing locational choice models of the form (but not necessarily of the content) outlined in equation (2) and (3) above.

The steps followed in the ensuing analyses include:

1) selecting a variable set for inclusion in the model equation;
2) assessing the efficiency of the model for allocating mover households among a set of potential area type destinations. Within

this section the contribution of the spatial distribution of vacancies to household allocation is examined;

3) the model is then extended to one which allocates households among locations (in fact, sub-urban regions) within the city. At this stage the influence of area heterogeneity on model performance is assessed, and a brief comparison is made of the relative success of the two principal forms of location allocation model;

4) finally the predictive efficiency of the location allocation models are tested with a sample of households excluded from the model building phase.

DEFINITION OF VARIABLES AND PRELIMINARY ANALYSES

The research problem, in operational terms, involves a set of households (N = 135)[2] who changed their place of residence within Christchurch during 1974. The distribution of move outcomes is presented in Figure 7.2. Given that a group of households have made a set of locational choices the task becomes one of isolating those factors which provide an explanation of their move outcomes. A number of approaches could be adopted for this problem: for instance, what were the factors which 'pushed' the households from their previous location and/or 'pulled' them towards their present place of residence (in particular, see Lee, 1966); to what extent did the structural and attitudinal characteristics of mover households determine the type of locational choice made (see Sabagh et. al., 1969); or how closely do the residential search and selection processes (after Brown and Moore, 1970) of a set of households who moved to one particular location within the city parallel those of a group of households who moved to a different location?

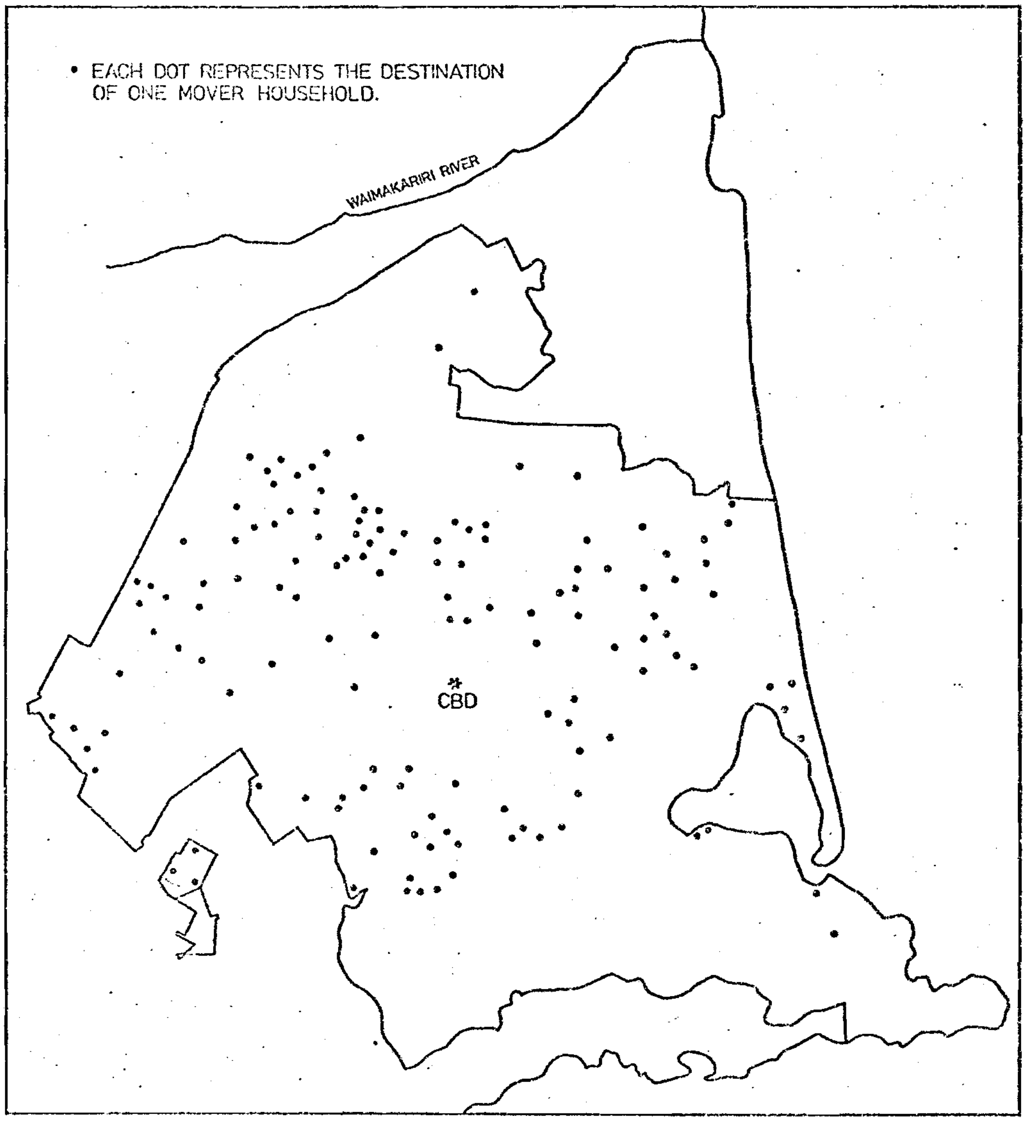


FIGURE 7.2 : DESTINATION LOCATIONS OF SURVEYED MOVER HOUSEHOLDS

Preliminary analyses based on household mobility data for Newcastle, N.S.W. (Newton, 1975c) indicated that, within the framework of a linear model, the contribution of attitudinal variables and indices of household search behaviour to an explanation of locational choice was minimal. As a consequence of these analyses attitudinal and search factors have been omitted from present model specification. In deciding upon the theoretical content for the location allocation models developed here, consideration was given to several generalisations which have emerged from the literature on residential location. These generalisations are consistent with the guiding preference-constraint framework and at the same time facilitate the development of urban structure - individual behaviour models of locational choice.

Locational Choice Generalisations

1) *When changing residence within a city a mover household will (or may) choose or be forced to live among households with similar social and demographic characteristics to its own.*

This generalisation, and the one which follows, embodies part of what has been referred to as the 'social choice' hypothesis. Advocates of this hypothesis assert that the selection of a location is dictated by a desire for physical proximity to those households of similar socio-economic and life cycle position who share, or are perceived to share, similar life styles (Bell, 1956; Moriarty, 1970).

Variables chosen to index this factor are:

NBD PREF:SES - a measure of intensity of response to the question:
"What proportion of people in your next neighbourhood would you like to have at a similar economic level to yours?"

NBD PREF:AGE - a measure of intensity of response to the question:

"What proportion of people in your next neighbourhood would you like to have in a similar age group to yours?"

A reality of our urban society, however, is the existence of groups of particular social classes whose relative lack of command over resources (primarily economic) impair their ability to achieve a preferred level of residence and location. Residentia segregation within cities is as much (and probably more) an expression of differential access to resources as it is a reflection of household preferences for particular types of location.

The variable chosen to index this factor is:

HHOLD S.E.S. - a multivariate index which incorporates measures on the following three attributes of the head of the household: occupational status, income and education. Additional information relating to this component is contained in Table 6.2 and the associated text.

2) *When changing residence within a city a mover household will select an area which contains housing and amenities with the necessary attributes to satisfy its residential needs.*

The studies of Weiss et. al., (1966), Daly (1968), Simmons (1968) and Michelson (1970, 1972), to name but a few, clearly indicate that many intra-urban residence shifts are initiated to improve some aspect of the housing environment: internal space, quality of dwelling and type of dwelling being among the more important. While Michelson (1966) indicates that there may be little variation between socio-economic groups when eliciting information on unconstrained residential preferences, there can be no doubt that different family life cycle stages generate varying housing needs. Space requirements in particular fluctuate according to family life cycle stage.

Analysis of a city's housing stock (as in Chapter 3) reveals a segmentation according to size, quality, architectural style, building type and so on. What is also revealed is a tendency for spatial concentrations of particular types, qualities, etc. of housing - although varying levels of mixture can be expected across the residential areas of a city (again, see Chapter 3, and Newton and Johnston, 1976). The significance of area housing submarkets in modelling household locational choice rests with the fact that movement is most likely to occur to those areas (area housing submarkets) containing dwellings of the type necessary to satisfy stated housing preferences.

The measures of housing preference selected for modelling locational choice are the same as those employed in modelling residence choice (see Table 6.17 and associated text. These are:

RES PREF: DWG SIZE
RES PREF: DWG CONDIT
RES PREF: DWG TYPE

Household life-cycle related factors (see Tabel 6.2 and associated text), included as likely sensitisers of housing and neighbourhood environments (particularly along a familism-urbanism continuum) are:

HHOLD LIFE CYCLE.
HHOLD SIZE

3) *When changing residence within a city a mover household will locate in that part of the city which meets its accessibility requirements to those nodes with which there is frequent, routinised, contact.*

Proponents of the economic competition hypothesis argue that variation in the locational behaviour of residential decision makers is due to differences in their budget costs and income resources, and it is this factor which determines the spatial distribution of socio-economic groups within the city. Journey to work and site costs are traded off against one another prior to a decision being made concerning residential location.

It is apparent, however, that a majority of households appear to consider access to workplace (and to some extent access in general - i.e. to shops, schools, friends, parks, CBD, public transport) as an inferior good when locating their residence within an urban area (Catanese, 1970; Johnston, 1971). Most residential mobility studies which solicit reasons for moving and locational requirements for the prospective residence (Ross, 1962; Kalbach, Myers and Walker, 1964; Stegman, 1969; Newton, 1975c) identify a group of households for whom access is an important requirement. It is necessary that the preferences of such a group be accommodated in models of locational choice.

In this study, calibration of accessibility preferences within the locational choice model is achieved by the inclusion of three dimensions of access preference in preliminary model equations. The three dimensions derive from a principal components analysis of responses to ten statements designed to elicit, for each household, the relative importance of being close to particular activity nodes: the place where most of the shopping was done, the homes of best friends, primary school, centre of town, park or open space, workplace of head, spouse's workplace, church, public transport and outskirts of the city. With the exception of 'centre of town' (the Square in Christchurch), all statements were not location-specific, but rather provide the basis for obtaining a measure of the degree of importance a household attaches to being in close proximity to specific activity nodes. The component loadings of the accessibility statements are represented in Table 7.1.

The access dimensions to be entered into locational choice models are:

ACC PREF: R.A.N. - a measure of the preference revealed by intendedly mobile households for access to routinised (as opposed to discretionary - see Chapin, 1974) activity nodes such as shops, CBD, workplace, and public transport routes.

ACC PREF: C.C.A.N. - a factor which reveals the preference level households display for access to child-centred activity nodes (primary school, park).

ACC PREF: SUBURBS - a factor whose prime identification is with aspects of accessibility within the suburbs - both to the outskirts of the built up area and to the homes of friends located throughout the residential suburbs of the city.

In addition to the access-preference indices outlined above, a further variable, which indicates whether or not the head of the household drives his own car to work is included in the initial model equation:

J-T-W MODE - this variable is taken to represent, albeit crudely, a current form of behaviour which is likely to be continued at a future residential location. It is argued that those in the sample who, at the time of survey, drove their own car to work would, as a group, be more wide-ranging and more likely to consider outer suburban areas in their search for alternative locations[3].

4) When changing residence within a city a mover household will be constrained in its residential choice by:

a) the availability and/or

b) the cost,

of various housing (or land) bundles located at different points within the city.

a) availability of housing: of the few mobility studies which incorporate the vacancy pattern in their modelling

TABLE 7.1

HOUSEHOLD PREFERENCES
FOR ACCESSIBILITY *

VARIABLES	COMPONENTS 1.	2.	3.	H^2
SHOPS	69			51
CBD	83			71
WORKPLACE	64			56
PUBLIC TRANSPORT	69			56
PRIMARY SCHOOL		69		53
PARK		81		65
FRIENDS			50	45
OUTSKIRTS OF CITY			91	83
CUM. % VARIATION	26	45	60	
EIGENVALUE	2.4	1.3	1.1	

* VARIMAX ROTATED PCA
LOADINGS >50 INCORPORATED IN TABLE

COMPONENT LABEL :

1. ACCESS TO ROUTINISED ACTIVITY NODES
2. CHILD CENTERED ACCESS REQUIREMENTS
3. SUBURBAN ACCESS

of population flows within the city (Brown and Longbrake, 1970; Moore, 1972), all assume the vacancies to be of equal quality.

TOTAL VACANCIES - is the variable chosen to index the total number (i.e. pattern) of vacancies occurring - irrespective of type and quality - in particular subareas of Christchurch between January and October 1974.

The analyses presented in Chapter 4 clearly demonstrated that such an assumption (i.e. homogenous vacancies) is unrealistic. It is necessary to incorporate a measure of both the structure <u>and</u> pattern of vacancies in locational choice models.

Four major vacancy submarket types were identified in earlier analyses: medium cost vacancies; older, lower priced vacancies; high cost vacancies; and ownership flat vacancies. They constitute the basis for deriving four binary (dummy) variables[4] for entry into a locational choice model.

It will be recalled from Chapter 4 that a spatial representation of Christchurch's vacancy structure was obtained by identifying those areas whose component score on each vacancy submarket dimension was > +1.0 standard deviations from the mean (see Figures 4.9 to 4.12). This effectively isolated those districts which had a reasonably high proportion of vacancies of the type specified by the dimension in question. For the present modelling exercise, a mover household scores the value of unity if its residence-destination is in an area whose component score on a particular vacancy submarket dimension is > + 1.0 s.d.:

MED. COST VACANCIES OLDER, LOWER PRI VAC HIGH COST VACANCIES OWNERSHIP FLAT VAC	dummy value = 1 if location in specified area

b) cost constraint: the restrictions imposed by a household's housing budget on the choice of residence and location have been, in general terms, well documented (see Simmons, 1968). In addition to the measure of household socio-economic status introduced above, two additional 'constraint' variables are included for location allocation modelling:

EXPECTED PRICE - a variable which indexes a household's assessment of the price ceiling likely to be employed when searching for a dwelling and location.

AMOUNT OF LOAN - an assessment of the proportion of the 'expected price' which would have to be met via loan from Government or private (e.g. building societies, banks, etc.) sources.

Having identified those variables which are to be examined for their contribution to an explanation and prediction of household locational choice behaviour, the theoretical model conforms to the following structure (an extension of equation (3) outlined earlier in the chapter):

$$L = f(A, B, C, D, E, F, G)$$

where A = household characteristics (3);

B = neighbourhood preferences (2);

C = residence preferences (3);

D = access preferences (3);

E = journey to work mode (1);

F = household constraints (2);

G = area vacancy characteristics (4);

L = area chosen by mover household (in regression analyses, values are area component scores from particular dimensions of urban structure; in discriminant analyses, values are particular area types or regions).

Variable Reduction Via Stepwise Regression Analysis

To establish whether this theoretical model performs satisfactorily as an empirical, statistical model, stepwise regression analysis was undertaken (after Weiner and Dunn, 1966) prior to multiple discriminant analysis to indicate those variables likely to perform best as determinants of household locational choice behaviour.

Six stepwise regression analyses were undertaken, using as predictors the 18 variables outlined above. Dependent variables were the component scores, on six principal dimensions of population and housing structure, of the destination areas (census districts) chosen by the sample of mover households. These models are effectively unidimensional locational choice models, in which variables explaining the greatest amount of variation in the dependent variable (or alternatively, which provide most information on household locational choice, where choice is between areas differentiated on the basis of a single dimension) are listed.

A summary of results is presented in Table 7.2. It is apparent from Models, 1 2 and 6 (all of which relate to movement to areas of varying housing quality and prestige) that several variables emerge as important descriptors of the locational choice process. In all cases, a household's estimate of its expected housing expenditure provides the best guide concerning the locational outcome of a move. It will be remembered that this variable acted as the criterion in analyses of residence choice (Chapter 6), thereby providing a useful link between the two move outcomes. The fact that variables such as household socio-economic status, household size and access to loan finance are correlates of expected purchase price (see Table 6.19), explains their entry at a lower stage (or step) during statistical

TABLE 7.2

STEPWISE REGRESSION ANALYSES OF
LOCATIONAL CHOICE INDICANTS

MODEL 1.

STEP	VARIABLE ENTERED	R
1	EXPECTED PRICE	0.63
2	HIGH PRICE VAC.	0.65
3	HHOLD SIZE	0.66
4	HHOLD LIFE CYCLE	0.68
5	AMOUNT OF LOAN	0.69
6	MED.COST VAC.	0.70

MODEL 2.

STEP	VARIABLE ENTERED	R
1	EXPECTED PRICE	0.49
2	OLD,LOW PRICE VAC.	0.55
3	MED.COST VAC.	0.59
4	RES PREF:CONDITION	0.61
5	ACC PREF:R.A.N	0.64
6	NBD PREF: AGE	0.65
7	RES PREF:DWG SIZE	0.67

MODEL 3.

STEP	VARIABLE ENTERED	R
1	RES PREF:DWG SIZE	0.38
2	ACC PREF:R.A.N	0.41
3	J-T-W MODE	0.45
4	O/SHIP FLAT VAC.	0.48

MODEL 4.

STEP	VARIABLE ENTERED	R
1	RES PREF:DWG SIZE	0.27
2	J-T-W MODE	0.33
3	ACC PREF: C.C.A.R	0.36
4	O/SHIP FLAT VAC.	0.38
5	RES PREF:CONDITION	0.40
6	ACC PREF: R.A.N	0.41
7	NBD PREF: AGE	0.43

MODEL 5.

STEP	VARIABLE ENTERED	R
1	OLD,LOW PRICE VAC.	0.43
2	RES PREF:DWG SIZE	0.54
3	MED.COST VAC.	0.59
4	O/SHIP FLAT VAC.	0.61
5	EXPECTED PRICE	0.62
6	NBN PREF:S.E.S	0.63
7	HHOLD SIZE	0.64
8	HHOLD LIFE CYCLE	0.65

MODEL 6.

STEP	VARIABLE ENTERED	R
1	EXPECTED PRICE	0.65
2	HIGH PRICE VAC.	0.68
3	HHOLD LIFE CYCLE	0.70
4	HHOLD S.E.S	0.71
5	NBD PREF:S.E.S	0.72
6	NBD PREF: AGE	0.73

MODEL	DEPENDENT VARIABLE
1	AREA HOUSING VALUE(MED/HIGH VALUE HOUSING)
2	AREA HOUSING QUALITY(LOW QUALITY HOUSING)
3	AREA DWELLING TYPE
4	AREA TENURE STATUS/LIFE STYLE
5	AREA LIFE CYCLE
6	AREA S.E.S

modelling. However, apart from 'access to loan finance', their contribution to overall explanation is sufficient to warrant their inclusion in later phases of modelling.

It is also evident that the vacancy structure (e.g. 'high priced vacancies', 'old, lower priced vacancies', and 'medium cost vacancies') plays an important role in directing the flow of movers among the residential areas of Christchurch. The variable 'total vacancies', in contrast, does not significantly contribute to location-allocation and is removed from subsequent consideration. Dwelling, neighbourhood and access preference factors do not emerge as the prime determinants of locational choice, but make sufficient contribution to warrant inclusion in discriminant models of locational choice.

The remaining models (3, 4 and 5) serve to identify principal factors involved in the redistribution of mover households among localities which are differentiated, for the most part, according to life cycle and life style-related attributes. In these models residence and access preference factors assume a more significant role in location allocation than has previously been the case. This indicates that when our focus shifts to multi-dimensional locational choice models (involving allocation of mover households to areas differentiated on more than one dimension of urban social and housing structure) a wider range of variables, approximating the set outlined earlier from a conceptual-theoretical point of view, is required to adequately explain and predict the locational choices of intra-urban movers.

DISCRIMINANT MODELS OF LOCATIONAL CHOICE

1. Allocation of Households to Area Types

The stepwise regression analyses have given preliminary confirmation to the theoretical model structure outlined earlier.

Foremost among the variables in the model equations are indicants of a mover household's socio-economic position. It is this factor which contributes most to the sifting and sorting of households among locations. Since there are normally several areas within a city which offer housing of a similar price bracket, additional factors are required to adequately explain a household's choice of one locality over the others. Household residential and access preferences and the spatial distribution of housing opportunities both emerge as useful contributors to this task.

In modelling household locational choice behaviour, the question arises of how best to represent potential destination areas. Clearly the representation must be multi-dimensional. The results of analyses in Chapters 2 through 4 suggest several dimensions which summarise the major population and housing components of an urban system. Residential areas can be classified according to their position on one or more of these dimensions (see Chapter 5) - dimensions which have counterparts in the demand side of a locational choice equation.

The first discriminant model of locational choice is based on a typology in which areas are classified according to population characteristics of residents (see Figure 5.6). Six area population types represented the destination choices of the 120 mover households (there were eight potential area type destinations) in a model which is established on the premise (see Generalisation 1) that a mover household will choose, or be forced, to live among households with similar social and demographic characteristics to its own. Table 7.3 summarises the results of this discriminant analysis. Inspection of this table reveals that 41 percent of the intragroup variability is concentrated in the first linear discriminant function (LDF).

TABLE 7.3

LOCATIONAL CHOICE DISCRIMINANT
MODELS : AREA TYPE CHOICE
1. POPULATION TYPES

INDICANTS	DISCRIMINANT FUNCTIONS * I	II	III
	** (***)		
EXPECTED PRICE	03 (49)	03 (60)	03 (33)
NBD PREF: S.E.S	15 (20)	-24 (-24)	-03 (-28)
NBD PREF: AGE	-07 (01)	10 (09)	-04 (-14)
J-T-W MODE	-02 (04)	-06 (-12)	36 (52)
HHOLD LIFE CYCLE	01 (13)	01 (35)	00 (08)
HHOLD SIZE	-01 (11)	-02 (-06)	03 (54)
HHOLD S.E.S	01 (50)	03 (41)	-03 (-08)
RES PREF:DWG SIZE	02 (39)	-01 (-46)	01 (07)
RES PREF:DWG CONDIT	00 (22)	-01 (16)	01 (40)
RES PREF:DWG TYPE	-01 (-19)	01 (06)	-01 (-22)
ACC PREF: R.A.N	01 (14)	00 (-02)	01 (07)
ACC PREF: C.C.A.R	-01 (04)	00 (-02)	00 (-05)
ACC PREF: SUBURBS	00 (06)	00 (19)	00 (17)
MED.COST VACANCIES	-51 (-23)	20 (19)	87 (50)
OLDER,LOWER PRICED VAC	44 (45)	-83 (-50)	22 (06)
HIGH COST VACANCIES	60 (54)	44 (37)	-01 (28)
OWNERSHIP FLAT VAC	39 (45)	-05 (00)	-26 (-04)
PERCENT VARIANCE EXPL'D	41	36	12
CHI-SQUARE	62.3	74.2	31.7
DEGREES OF FREEDOM	21	19	17
SIGNIFICANCE LEVEL	<.00001	<.00001	<.05
WILKS LAMBDA		0.13	
F-RATIO		2.91	
DEGREES OF FREEDOM		85,478	

* INCLUDES LDF'S SIGNIFICANT AT P<.05

** DISCRIMINANT WEIGHTS(TRUNCATED TO TWO FIGURES)

*** DISCRIMINANT LOADINGS

The second and third LDF's, which are also statistically significant account for 36 and 12 percent respectively of the variability in the data. Subsequent functions which did not meet the required level of significance are not considered.

The nature of each discriminant function is determined by examining the discriminant loadings. Interpretation is analogous to that of the loadings in a principal components analysis. Several variables, particularly those which are related to the social and economic attributes of mover households (e.g. expected purchase price, household socio-economic status, dwelling size preference) figure prominently on the first two LDF's, indicating the overall significance of the economic factor in location allocation. An important loading on the second function - which sets it apart from the first - is household life cycle, thereby demonstrating that life cycle position exerts what could be termed a secondary influence on locational choice. A further secondary influence, which is highlighted on the third LDF, appears to relate to a household's preference or willingness towards living in central city or suburban locations (witness loadings on journey to work mode, household size and dwelling condition preferences).

The second discriminant model is based on household movement to areas classified in terms of the characteristics of the housing stock (see Figure 5.8). Seven area housing types represented the destination choices of the mover households in a model established on the premise (see Generalisation 2) that a mover household will select an area which contains housing with the necessary attributes to satisfy its residential needs. Table 7.4 displays the results of this analysis. Again three discriminant functions (from a total of 6) prove to be

TABLE 7.4

LOCATIONAL CHOICE DISCRIMINANT
MODELS : AREA TYPE CHOICE
2. HOUSING TYPES

INDICANTS	DISCRIMINANT FUNCTIONS * I	II	III
	** ***		
EXPECTED PRICE	07 (81)	01 (-01)	02 (23)
NBD PREF: S.E.S	-20 (-15)	-07 (13)	05 (-10)
NBD PREF: AGE	03 (08)	08 (08)	16 (02)
J-T-W MODE	05 (04)	-32 (-52)	-07 (-17)
HHOLD LIFE CYCLE	02 (40)	00 (15)	00 (-03)
HHOLD SIZE	-02 (06)	01 (-04)	01 (11)
HHOLD S.E.S	02 (50)	02 (11)	01 (24)
RES PREF:DWG SIZE	01 (-12)	02 (25)	-01 (-11)
RES PREF:DWG CONDIT	-02 (18)	-02 (-27)	-01 (01)
RES PREF:DWG TYPE	00 (-03)	02 (16)	-01 (-31)
ACC PREF: R.A.N	01 (06)	-01 (-20)	03 (45)
ACC PREF: C.C.A.R	00 (-02)	00 (-04)	-02 (-34)
ACC PREF: SUBURBS	00 (13)	00 (11)	00 (04)
MED.COST VACANCIES	-46 (-21)	21 (-03)	44 (31)
OLDER,LOWER PRICED VAC	-56 (-22)	-18 (-19)	71 (30)
HIGH COST VACANCIES	65 (45)	-14 (-32)	-46 (-08)
OWNERSHIP FLAT VAC	05 (12)	-69 (-64)	-23 (-11)
PERCENT VARIANCE EXPL'D	50	16	14
CHI-SQUARE	82.9	33.5	29.5
DEGREES OF FREEDOM	23	21	19
SIGNIFICANCE LEVEL	<.00001	<.05	<.05
WILKS LAMBDA		0.16	
F-RATIO		1.69	
DEGREES OF FREEDOM		119,636	

* INCLUDES LDF'S SIGNIFICANT AT P<.05

** DISCRIMINANT WEIGHTS

*** DISCRIMINANT LOADINGS

statistically significant, the first explaining a considerably higher proportion of variance than the remaining functions. It is also evident that the social and economic attributes of households continue to act as the principle allocation mechanism within an urban area's housing stock (see loadings on first LDF). The vacancy structure also figures prominently in both discriminant models, a feature which will be discussed more fully later in the chapter.

The separate population and housing classifications (on which the previous discriminant models have been based) provide only a partial representation of a city's residential structure. In extending the generality of our location allocation model, an area typology employing population and housing attributes provides the basis for the next phase of modelling. Four population and housing types represented the destination choices of the sample of 120 mover households (there were 7 potential destination types - see Figure 5.10). Only two discriminant functions are required to account for the majority of variance in mover behaviour - and the loadings on these functions do not suggest a radical departure in strength and direction from those already described. (Table 7.5)

The axes corresponding to both discriminant functions represent dimensions along which significant differences in the locational behaviour of mover households may be found. A plot of the group centroids and individual discriminant scores (Figure 7.3) provides an opportunity to make a visual assessment of the nature of group separation. It is apparent that discriminant function I serves to separate movers to area type 5 (an 'outer suburban type') from movers to area types 1, 2 and 4 (which comprise, respectively: neighbourhoods of older, single family, owner-occupied dwellings; high status neighbourhoods;

TABLE 7.5

LOCATIONAL CHOICE DISCRIMINANT
MODELS : AREA TYPE CHOICE
3. POPULATION & HOUSING TYPES

INDICANTS	DISCRIMINANT FUNCTIONS I	II	III
	* **		
EXPECTED PRICE	02 (44)	04 (69)	02 (06)
NBD PREF:S.E.S	03 (21)	-20 (-22)	39 (29)
NBD PREF: AGE	-02 (05)	06 (02)	05 (24)
J-T-W MODE	-06 (-05)	04 (01)	14 (14)
HHOLD LIFE CYCLE	02 (26)	00 (35)	-01 (-08)
HHOLD SIZE	-01 (08)	00 (11)	02 (19)
HHOLD S.E.S	01 (40)	03 (42)	01 (12)
RES PREF:DWG SIZE	02 (43)	-02 (-50)	03 (42)
RES PREF:DWG CONDITION	-01 (04)	-02 (19)	-02 (-04)
RES PREF:DWG TYPE	-01 (-21)	01 (-02)	01 (17)
ACC PREF: R.A.N	01 (07)	00 (00)	01 (09)
ACC PREF: C.C.A.R	01 (19)	01 (-04)	-03 (-31)
ACC PREF: SUBURBS	01 (15)	00 (21)	-03 (-32)
MED.COST VACANCIES	-72 (-42)	13 (12)	10 (-25)
OLDER,LOWER PRICED VAC	51 (42)	-83 (-51)	-89 (-34)
HIGH COST VACANCIES	41 (35)	46 (36)	-10 (-21)
OWNERSHIP FLAT VAC	19 (28)	-18 (-06)	11 (-03)
PERCENT VARIANCE EXPL'D	54	42	4
CHI-SQUARE	74.4	61.7	8.0
DEGREES OF FREEDOM	19	17	15
SIGNIFICANCE LEVEL	<.00001	<.00001	>.92
WILKS LAMBDA		0.27	
F-RATIO		3.25	
DEGREES OF FREEDOM		51,299	

* DISCRIMINANT WEIGHTS (TRUNCATED TO TWO FIGURES)
** DISCRIMINANT LOADINGS

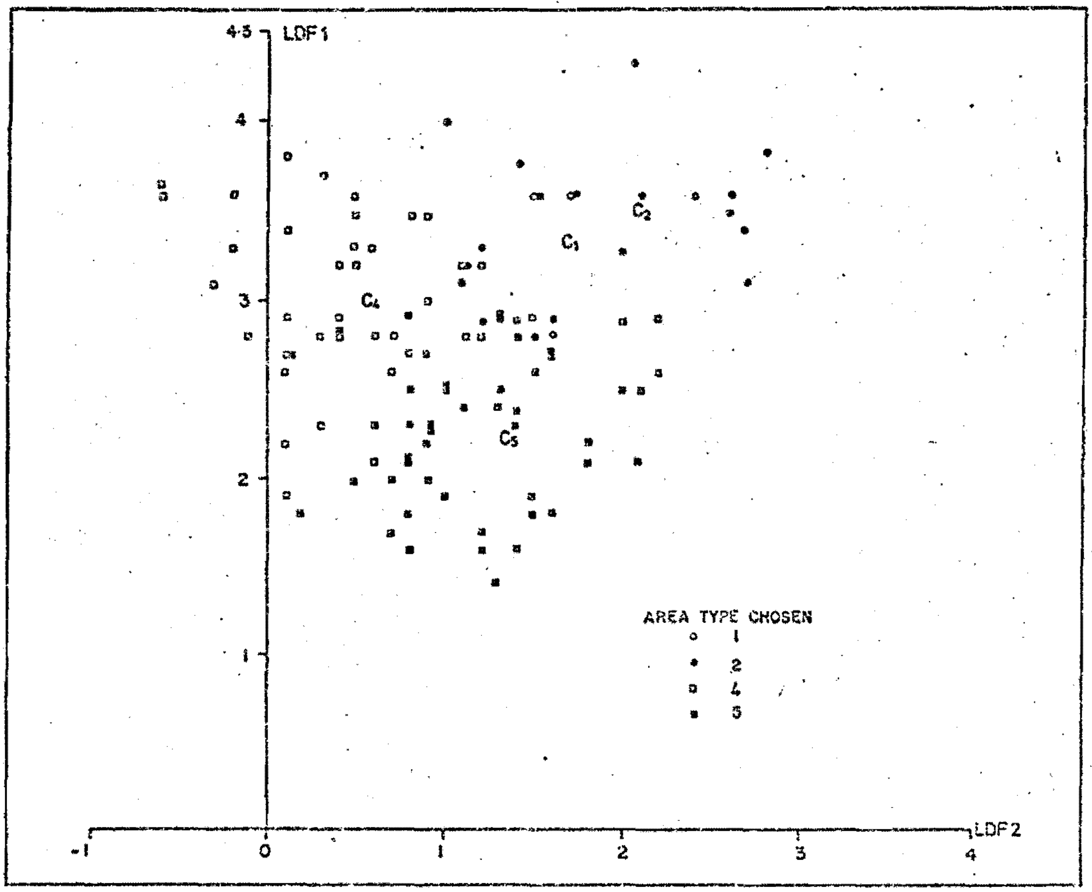


FIGURE 7.3 : LOCATION OF MOVER HOUSEHOLDS IN TWO DIMENSIONAL DISCRIMINANT SPACE

and a middle ring of post World War II suburbs of medium to low status). Additional discrimination is afforded by LDF II, which is primarily concerned with the separation of households moving to area type 4, area type 2 and area types 1 and 5.

Although 17 independent variables are by no means a particularly large predictor set for discriminant analyses[5], an increasingly common objective in empirical studies is variable reduction (Weiner and Dunn, 1966; King, 1970). A common procedure for deletion of variables, and one which is followed here, employs F tests on individual predictors (Table 7.6). Of the 17 variables incorporated in location allocation among area types classified according to population and housing attributes, 9 proved to be poor discriminators on an individual basis ($p <.200$). A further discriminant analysis was performed on the remaining 8 variables.

Another important objective of the present study involved an assessment of the influence of the vacancy structure on locational choice (Generalisation 4). If the vacancy structure were to exert no influence on the spatial outcome of an intra-urban move, then a discriminant model based on 17 predictors (which includes 4 'vacancy' variables) should predict move outcomes no better than a model based on 13 predictors (in which the vacancy measures were absent). This premise was examined via a 13 variable discriminant analysis.

One means by which the relative performance of the five discriminant models can be assessed involves the success with which the mover households were assigned to area types. A priori group membership is given as the area type actually chosen by the mover household. In Model 1 (Table 7.7), 75 percent of households were correctly allocated to area population types. For Model 2, this percentage dropped to 62 percent.

TABLE 7.6

UNIVARIATE F-TESTS ON LOCATIONAL CHOICE INDICANTS

	POPULATION AND HOUSING TYPES	
VARIABLE	F-RATIO	P
EXPECTED PRICE	16.56	.000
NBD PREF:S.E.S	1.93	.126
NBD PREF: AGE	0.22	.885
J-T-W MODE	0.10	.957
HHOLD LIFE CYCLE	3.71	.013
HHOLD SIZE	0.43	.737
HHOLD S.E.S	6.95	.000
RES PREF:DWG SIZE	10.57	.000
RES PREF:DWG CONDIT.	0.63	.601
RES PREF:DWG TYPE	0.97	.589
ACC PREF: R.A.N	0.11	.951
ACC PREF: C.C.A.R	0.98	.594
ACC PREF: SUBURBS	1.49	.220
MED.COST VACANCIES	4.13	.008
OLDER,LOWER PRI VAC	9.96	.000
HIGH COST VACANCIES	5.23	.002
OWNERSHIP FLAT VAC	1.57	.200

TABLE 7.7

SUCCESS OF DISCRIMINANT MODELS
IN ALLOCATING MOVER HOUSEHOLDS TO AREA
TYPES

1. ALLOCATION TO AREA POPULATION TYPES

ACTUAL AREA TYPE CHOSEN

AREA TYPE ALLOCATED VIA MODEL	1	3	4	5	6	7	
1	14	0	0	0	4	0	18
3	0	1	0	0	0	0	1
4	3	0	22	0	3	0	28
5	0	0	3	3	5	0	11
6	2	0	8	0	49	0	59
7	0	0	1	0	1	1	3
	19	1	34	3	62	1	120

CORRECT ALLOCATIONS : 75%

2. ALLOCATION TO HOUSING TYPES

ACTUAL AREA TYPE CHOSEN

AREA TYPE ALLOCATED VIA MODEL	1	2	3	5	6	7	8	
1	2	1	0	1	1	0	0	5
2	0	6	0	12	0	0	0	18
3	0	0	3	1	0	0	0	4
5	0	2	0	48	1	1	0	52
6	0	0	0	11	9	0	0	20
7	0	0	0	8	1	5	0	14
8	0	1	0	2	0	0	1	4
	2	10	3	83	12	6	1	120

CORRECT ALLOCATIONS : 62%

When allocation was undertaken to areas classified in terms of both population and housing components, the discriminant model successfully placed 78 percent of households (Table 7.8). The reduced level of misallocation may be taken as an initial indication of the contribution of a more comprehensive areal classification to improved model performance.

The remaining two matrices displayed in Table 7.8 clearly indicate:

1) that the vacancy structure of an urban area exerts an important influence on household locational choice (viz. 65 percent correct allocation when vacancy attributes were removed from the model equation), and

2) that the 17 predictor variables on which most modelling has been based, constitute the best set of empirical as well as conceptual indicants of household locational choice behaviour (viz. 70 percent correct allocation when an eight variable model was employed).

A problem arises in attempting to assess the relative performance of these models, since they are based on household mobility behaviour among a differing number of destination areas: 6 in the case of movement to area population types, 7 in the case of movement to area housing types and 4 in the case of movement to area population and housing types. One can intuitively artue that 62 percent correct placements among 7 area types is better than 62 percent correct allocation among 6 area types - and attempt to extrapolate this principal to the present set of empirical results.

A more satisfactory approach is advanced by Tatsuoka (1970) who provides a formula for estimating the total discriminatory power of the model (analogous to percent

TABLE 7.8

SUCCESS OF DISCRIMINANT MODELS
IN ALLOCATING MOVER HOUSEHOLDS TO AREA
TYPES

3. ALLOCATION TO AREA POPULATION & HOUSING TYPES

#1 : 17 INDICANTS

		ACTUAL AREA TYPE CHOSEN				
		1	2	4	5	
	1	2	2	4	3	11
AREA TYPE	2	1	11	1	3	16
ALLOCATED	4	0	2	33	4	39
VIA MODEL	5	0	1	6	47	54
		3	16	44	57	120

CORRECT ALLOCATIONS : 78%

#2 : 13 INDICANTS

		ACTUAL AREA TYPE CHOSEN				
		1	2	4	5	
	1	2	2	4	3	11
AREA TYPE	2	1	11	1	7	20
ALLOCATED	4	0	2	26	8	36
VIA MODEL	5	0	1	13	39	53
		3	16	44	57	120

CORRECT ALLOCATIONS : 65%

#3 : 8 INDICANTS

		ACTUAL AREA TYPE CHOSEN				
		1	2	4	5	
	1	2	1	6	1	10
AREA TYPE	2	1	9	0	7	17
ALLOCATED	4	0	3	29	5	37
VIA MODEL	5	0	3	9	44	56
		3	16	44	57	120

CORRECT ALLOCATIONS : 70%

explained variance in regression analysis):

$$V = 1 - \frac{N}{(N-k)(1+\lambda_1)(1+\lambda_2)\ ..(1+\lambda_r) + 1}$$

where λ_1, $\lambda_2 \ldots$, λ_r are the eigenvalues relating to each LDF,

N is the total sample size, and

k is the number of groups

Applying this formula to the five locational choice models introduced thus far reveals the following figures (percentages) on total variance explained:

1.	Allocation to Area Types - Population	86.0
2.	Allocation to Area Types - Housing	82.2
3.	Allocation to Area Types - Population & Housing	72.3
3a.	Population & Housing: 13 indicants	56.5
3b.	Population & Housing: 8 indicants	66.2

While the total explanatory power of the discriminant models remained relatively high, the lower level of explained variance revealed by the Population & Housing Model ran counter to expectations, and counter to the figures on successful allocation of mover households. The high level of within area variance characterising census divisions assigned to the four area types possibly accounts for the lower level of explanation provided by this model (an assessment of the effect of area heterogeneity on model performance is undertaken in the next section).

Although the above figures provide one measure of model performance, the results are somewhat inflated since Tatsuoka's formula requires the inclusion of eigenvalues for all LDF's, irrespective of whether they are statistically significant or not. Since only significant LDF's were selected for interpretation and will subsequently form the basis for testing the predictive efficiency of the model, it seemed necessary to adjust the measure of explained variance accordingly. Rather than modify the formula, the measures of total variance listed above were adjusted in the following manner:

$$V_{adj} = V.\frac{\Sigma\lambda S}{\Sigma\lambda T}$$

where V is as defined above,

$\Sigma\lambda S$ is the sum of all 'significant' eigenvalues,

$\Sigma\lambda T$ is the sum of all eigenvalues.

The resultant values are:

1.	Allocation to Area Types - Population	76.3
2.	Allocation to Area Types - Housing	65.5
3.	Allocation to Area Types - Population & Housing	69.3
3a.	Population & Housing: 13 indicants	54.0
3b.	Population & Housing: 8 indicants	64.7

It is apparent that the Population and Housing model has improved its standing relative to the Housing model and the Population model, but still accounts for a smaller proportion of total variance than the latter. If intra-urban migration is seen to occur within constraints imposed by the urban area and from within the individual mover household (the premise on which the present study is based), the results listed above would appear to suggest that it is the distribution of social and demographic groups, rather than the distribution of housing, which is primarily responsible for directing population movement within our urban system.

2. Allocation of Households to Sub-Urban Regions

The importance of an area's location within the city system (i.e. its accessibility) has been the basis for many normative models of residential location and urban development (Lowry, 1968; Patton and Clark, 1970). The accessibility factor has been less prominent in behavioural studies of intra-urban migration, although most, if not all conceptualisations of the household location decision process incorporate access considerations within their schema.

In discussing the spatial aspects of intra-urban migration, Simmons (1968, p.639) considers that:

> *The location constraint operates in conjunction with other variables, and the requirement of living in a certain neighbourhood becomes difficult to fulfil only when housing of a certain size or standard is specified. More often location comes so far down on the hierarchy of criteria that the location of a dwelling results from decisions about other factors.*

Six years later, a similar set of comments were advanced:

> *Because location is usually not the first priority of movers, the destination location <u>follows</u> the housing selection. ... Again the success of models of relocation at any level - from individual household on up - lies in the ability to predict the distribution of housing opportunities of a certain kind (Simmons, 1974, p.101).*

While location per se is not assigned a completely passive role by Simmons (who is one of the few writers to comment on the role of location in household relocation behaviour) it is not seen to exert a primary influence on the spatial outcome of a move. Presumably Simmons would argue that, for most households, their activity set (work, shopping, social contacts, recreation, etc.) is adjusted following a residence-shift to compensate for the change in locus. Yet research on the location and configuration of the search space of mover households (Newton, 1975c) suggests that there are many areas of a city which are not considered as potential destination areas. It seems necessary, therefore, to incorporate a physical location factor in models of locational choice (again, see Figure 1.1 and associated text). The models outlined below are those concerned with the allocation of mover households to suburban regions (areas within the city which have been delineated according to population, housing and location attributes - see Chapter 5). A set of variables and subjects identical to that employed in the previous area type models allows comparison of results with the sub-urban region models.

Table 7.9 presents the discriminant loadings, weights and associated statistics for the locational choice model based on population and housing regions. Twenty-five areas acted as potential destinations for the sample of 120 mover households (see Figure 5.14). Eighteen of these regions received intra-urban movers. Of the seventeen discriminant functions generated, four proved statistically significant and form the basis for interpretation.

The dominant attributes on the first LDF primarily relate to socio-economic attributes of mover households and the structure of the city's vacancy market. The second LDF is, in many respects a mirror of the first, although there are moderate loadings on a number of life cycle related variables (neighbourhood preference: age, household life cycle, household size, and preference for access to child centred activity nodes). The remaining functions prove more difficult to label clearly, although the third LDF appears to discriminate between city and suburban locations. The success with which this model allocates households among population and housing regions is depicted in Table 7.10(1.). The percentage of correct allocations (57%) represents a considerable drop compared with its counterpart area type model (78%), although it will be remembered that the number of destination areas involved has increased from four to eighteen.

TABLE 7.9

LOCATIONAL CHOICE DISCRIMINANT MODELS

1. POPULATION AND HOUSING REGIONS

INDICANTS	DISCRIMINANT FUNCTIONS * I	II	III	IV
EXPECTED PRICE	** 01 (*** 37)	02 (62)	04 (31)	03 (12)
NBD PREF: S.E.S	00 (14)	-06 (-19)	-24 (-13)	31 (31)
NBD PREF: AGE	02 (08)	-04 (17)	15 (12)	-04 (09)
J-T-W MODE	-04 (-01)	09 (15)	-16 (-23)	06 (10)
HHOLD LIFE CYCLE	02 (31)	-01 (21)	01 (31)	-02 (-36)
HHOLD SIZE	-01 (09)	-01 (21)	-01 (-22)	01 (22)
HHOLD S.E.S	01 (35)	00 (-41)	03 (41)	00 (12)
RES PREF:DWG SIZE	02 (43)	-01 (43)	01 (-01)	05 (67)
RES PREF:DWG CONDIT	00 (10)	01 (02)	-04 (-29)	-01 (15)
RES PREF:DWG TYPE	-01 (-13)	00 (06)	01 (02)	01 (-05)
ACC PREF: R.A.N	01 (12)	00 (03)	-01 (-23)	00 (11)
ACC PREF: C.C.A.R	00 (15)	00 (19)	00 (-11)	00 (13)
ACC PREF: SUBURBS	00 (04)	00 (06)	00 (04)	-01 (06)
MED.COST VACANCIES	-72 (-45)	-06 (-55)	57 (29)	77 (36)
OLDER/LOWER PRICED VAC	69 (44)	-78 (55)	01 (02)	-53 (-05)
HIGH COST VACANCIES	45 (39)	59 (22)	06 (03)	01 (06)
OWNERSHIP FLAT VAC	21 (31)	18 (22)	-75 (-42)	15 (15)
PERCENT VARIANCE EXPL	28	22	14	9
CHI-SQUARE	100.8	85.3	62.6	43.2
DEGREES OF FREEDOM	33	31	29	27
SIGNIFICANCE LEVEL	<.00001	<.00001	<.001	<.05
WILKS LAMBDA		.013		
F-RATIO				
DEGREES OF FREEDOM				

* INCLUDES LDF'S SIGNIFICANT AT P <.05

** DISCRIMINANT WEIGHTS (TRUNCATED TO TWO FIGURES)

*** DISCRIMINANT LOADINGS

TABLE 7.10

SUCCESS OF DISCRIMINANT MODELS
IN ALLOCATING MOVER HOUSEHOLDS
TO RESIDENTIAL SUB-AREA LOCATIONS

1. ALLOCATION TO POPULATION AND HOUSING 'REGIONS'

ACTUAL LOCATION CHOSEN

LOCATION ALLOCATED VIA MODEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	
1	8		6		1														15
2		5	2					1		2									10
3	2		11		1							1							15
4			1	5	1			1		4									12
5			3		6			1		1				1					12
6					1	4													5
7						1	1			3									5
8					1			6		1	1								9
9									1	1									2
10			2	1						8									11
11		1									3								4
12	1				1							1							3
13								1					1						2
14	1													2					3
15			1	1	1										1				4
16			1													3			4
17				1													1		2
18																		1	1
	12	6	27	8	13	5	1	10	1	20	4	2	1	3	1	3	1	1	120

CORRECT ALLOCATIONS : 57%

2. ALLOCATION TO HIGHER ORDER 'REGIONS'

ACTUAL LOCATION CHOSEN

LOCATION ALLOCATED VIA MODEL	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	20	21	22
1	2			2												1					
2		5						2		1	1										
3			6					3							1						
4			1	7						1					1						
5					2			1													
6						6										1					
7			1	2			3														
8								5		1						1					
9									2	1											
10				1						6	1										
11				1				1		1	9										
12												3									
13													2								
14		1		2										3							
15			1	1											4	1					
16			1					1						1		6					
17																	2				
18								2								1		2			
20																			1	1	
21	1										1									1	
22																					1
	3	6	10	16	2	6	3	15	2	11	12	3	2	4	6	11	2	2	1	2	1

CORRECT ALLOCATIONS : 65%

If location plays an intrinsic role in household relocation behaviour then the model which allocates households among sub-urban <u>regions</u> would be superior to a model based on area <u>types</u>. The figures presented above would suggest that this is not the case, yet one is confronted with a problem of comparing discriminant analyses where allocation is undertaken among a different number of potential destination areas. An estimate of the total discriminatory power of the regional allocation model (Tatsuoka's formula) is 98.4 percent; its adjusted value is 71.3 percent. Both are higher than their counterpart model concerned with household allocation among area population and housing types (viz. 72.3 and 69.3 percent, respectively). Further evidence of the superior performance of the regional allocation model is gained by comparing the two model-forms on the following ratio:

$$\frac{\text{Percent Correct Allocations via Locational Choice Model}}{\text{Percent Correct Allocation via Random Distribution Model}}$$

The difference between a value of 11.4 (regional model) and 3.1 (area type model) is sufficient to indicate that, in addition to an area's population and housing attributes, its location within the urban system is an important additional factor considered by households who change residence within the city.

The nature of the models developed in this chapter depend, for a high level of explanation (and ultimately prediction) on the degree of mix among population and housing characteristics in the set of potential destination areas. At the beginning of the present chapter it was hypothesised that the greater the heterogeneity of an area, the greater is the potential for households with quite different residential needs to relocate within the same sub-area. Analyses of within-area variation (or area heterogeneity) undertaken in Chapter 3, and the subsequent higher order analyses, typologies and regionalisations undertaken in Chapter 5 provide the basis for such a test. The final locational choice model (termed 'higher order regional allocation'), with its 'built-in' adjustment for heterogeneity should result in a higher level of explanation.

Thirty-one regions acted as potential destination areas for the sample of 120 mover households (see Figure 5.15). Twenty-one of these regions received intra-urban migrants; twenty discriminant functions were generated, and five proved to be statistically significant (Table 7.11). The loadings are distributed among the LDF's in a slightly different manner compared with the previous model, although the principal contributors to location allocation remain household socio-economic indicators and area vacancy characteristics. The higher order regional allocation model has performed better than the previous model on a number of measures:

1) a higher proportion of households (65 percent) were successfully allocated to locations within the city (Table 7.10,2.);
2) the ratio of successful 'model' allocations to random allocations rose to a value of 13.0; and
3) the total discriminatory power of the higher order regional allocation model was computed as 99.6 percent (Tatsuoka's formula) and 76.0 percent (adjusted).

MODEL VALIDATION

> *With very weakly developed geographic theory and a highly complex multivariate subject matter, it is inevitable that the model concept should play a part in geographic explanation. In the absence of firm geographic theory, a model can provide a 'temporary' explanation or an objective (if often inaccurate) prediction. (Harvey, 1969, p.167).*

TABLE 7.11

LOCATIONAL CHOICE DISCRIMINANT MODELS

2. HIGHER ORDER REGIONS

DISCRIMINANT FUNCTIONS *

INDICANTS	I	II	III	IV	V
EXPECTED PRICE	** 04 (74)	01 (-04)	01 (-03)	02 (16)	- 04 (10)
NBD PREF: S.E.S	-12 (-21)	02 (05)	03 (10)	01 (-01)	63 (36)
NBD PREF: AGE	05 (08)	-04 (-02)	-05 (-02)	10 (15)	- 44 (-19)
J-T-W MODE	07 (16)	06 (11)	05 (10)	-08 (-09)	- 10 (-08)
HHOLD LIFE CYCLE	01 (30)	01 (-04)	01 (-01)	02 (25)	- 03 (-20)
HHOLD SIZE	00 (30)	-01 (07)	-01 (04)	-02 (03)	01 (21)
HHOLD S.E.S	00 (29)	-02 (-23)	-02 (-17)	00 (17)	04 (28)
RES PREF:DWG SIZE	00 (-13)	01 (30)	01 (45)	02 (31)	01 (15)
RES PREF:DWG CONDIT	01 (43)	02 (12)	01 (05)	03 (31)	02 (29)
RES PREF:DWG TYPE	-01 (-16)	-01 (00)	-01 (02)	01 (23)	03 (17)
ACC PREF: R.A.N	00 (10)	01 (26)	01 (20)	01 (16)	03 (36)
ACC PREF: C.C.A.R	00 (-05)	00 (13)	09 (19)	-01 (-12)	- 04 (-17)
ACC PREF: SUBURBS	-01 (07)	01 (-02)	01 (-03)	-01 (-02)	07 (61)
MED.COST VACANCIES	-49 (-22)	-55 (-56)	-53 (-52)	-03 (-18)	- 01 (01)
OLDER/LOWER PRICED VAC	-31 (-19)	59 (37)	65 (49)	18 (-05)	- 31 (-08)
HIGH COST VACANCIES	79 (64)	-44 (-26)	-34 (-18)	-23 (-23)	36 (13)
OWNERSHIP FLAT VAC	10 (25)	39 (32)	41 (36)	-95 (-69)	39 (08)
PERCENT VARIANCE EXPL	33	16	13	8	6
CHI-SQUARE	135.6	84.8	75.7	51.0	43.0
DEGREES OF FREEDOM	36	34	32	30	28
SIGNIFICANCE LEVEL	<.00001	<.00001	<.0001	<.01	< .05
WILKS LAMBDA			.004		
F-RATIO			1.81		
DEGREES OF FREEDOM			349,1131		

The previous sections have been concerned with articulating a model of locational choice for intra-urban migrants. A series of empirical models have been generated in an attempt to identify those factors which may be advanced in explanation of the choice process.

The next step in model development normally involves determining the validity of the model, and in the present context this implies predictive validity (Nunnally, 1967). In terms of the discriminant model, this consists of the assignment of uncategorised or 'stray' cases to their most likely group. Discriminant analysis was, in fact, developed for this specific task (i.e. allocating new observations to a set of pre-established classes on the basis of certain characteristics), although its most common use in current residential mobility research is as an aid in classification (Perilla, 1972; Doling, 1973; Poulsen, 1976).

To enable the predictive efficiency of one or more of the present set of locational choice models to be assessed, data on 15 mover households were withheld from the model generation phase. The allocation of new observations to their most likely destination area can be achieved quite simply by calculating the score of each of the 'strays' on each significant LDF, and then plotting these scores in order that the new cases be allocated to the area (group) whose centroid lies nearest to it (Mather, 1969; Nunnally, 1959; King, 1969).

The graphical method of allocating new observations to groups limits the test of predictive efficiency to the area population and housing type model which generated two significant LDF's. The position of the group centroids and new cases in two dimensional discriminant space is indicated in Figure 7.4. The area type model was able to satisfactorily assign ten of

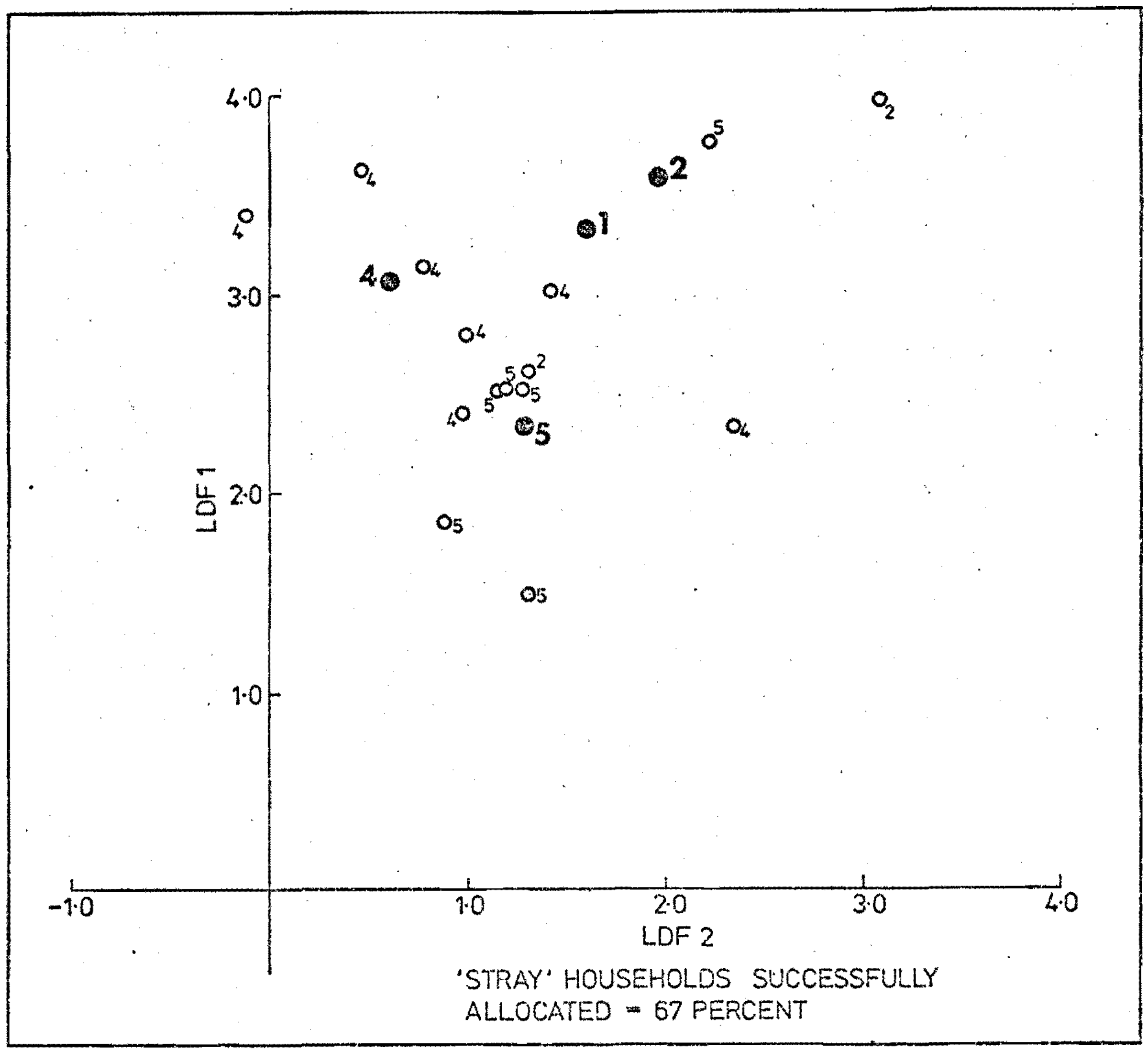


FIGURE 7.4 : GRAPHIC REPRESENTATION OF 'STRAY' SCORES DERIVED FROM THE AREA POPULATION AND HOUSING TYPE MODEL

fifteen (or 67 percent) mover households to locations within Christchurch. This result adds further confirmation to the viability of a structural model of household locational choice.

NOTES

1 As have been identified by the analyses in Part A of the study.

2 While the mover group constitutes 135 households, only 120 form the basis of the locational choice equations established in this chapter. Fifteen households were removed, at random, from the total mover group, thereby providing data necessary for testing the predictive efficiency of the location-allocation model.

3 These generalisations are based to some extent on ecological associations between journey to work modes and two locational variables: distance to CBD, and a measure of a census district's relative accessibility to all other census districts within the urban area (see Table V.1).

4 A useful summary of the use of dummy variables in linear regression models is found in Leistritz (1973) and Sappington (1970). The use of dichotomous scores in discriminant analysis is documented in Maxwell (1961) and Nunnally (1967).

5 Comparison can be made with the 47 variables in Buchanan's (1972) tobacco growers study; 55 variables in Bucklin's (1967) study of urban shopping patterns; 25 variables in Bledsoe's (1973) study of teacher competence; 25 variables in Casetti's (1964) analysis of Italian regions; 24 variables in King's (1967) study of Canadian urban growth patterns.

6 A random pattern of locational choice for the 120 households was achieved by assigning each household a grid coordinate from random number tables.

This position was transferred to a location within the Christchurch urban area via a rectangular grid overlay. Hits and misses were identified with reference to Figure 5.11 and a list of addresses representing the actual locational choice of the mover households.

CHAPTER EIGHT

CONCLUSION

SUMMARY

Most fields of study have a body of literature and research findings which, when carefully considered, suggest directions which future research should take. The present study is, in many respects, a product of its antecedants. The mobility schema adopted for this dissertation departed from the highly individualised conceptualisations, exemplified by Brown and Moore (1968, 1970), of the residential mobility process (in themselves a product of the behavioural influence within geography). Instead, three principal outcomes of the residential mobility process were identified and separately modelled for a group of mover households: the decision to move, residence choice and locational choice. Results embodied in Part B appear to have vindicated this approach, and clearly indicate that each outcome has potential theoretical as well as applied value.

The principal research focus of the thesis involved modelling household locational choice, and as belies the title of the dissertation, the guiding premise was that the existing residential structure of an urban area exerted a major influence in determining the spatial outcome of an intra-urban move[1]. The suggestion was that urban spatial structure and the behaviour of individuals and households within that structure be considered together, and that models of locational choice should be based on behaviour-structure linkages.

An empirical test of this theoretical nexus was made possible by utilising the methodologies and accumulated findings from two related, but at the time largely unconnected, areas of research: aggregate studies (particularly social area analysis, factorial ecology and areal classification) and studies of individual mobility behaviour.

The conceptual basis for an integrated model of residential location is due to Berry and Rees (1969) who specified how the principal findings from factor ecological analyses could be linked with individual household data. This schema was extended in the present study to incorporate the following features:

1) a more detailed sensitisation of urban residential space. Potential destination areas were characterised by housing as well as population attributes,

2) isolating the structure and pattern of the city's vacancy market (the hypotheses being that vacancy characteristics are important factors in directing the flow of intra-urban movers),

3) determining the level of homogeneity within residential subareas (the hypothesis being that the greater the heterogeniety of an area, the greater is the potential for households with quite different residential needs to relocate within the same residential subarea),

4) an identification of the role of location in locational choice models, and

5) a formal statement of those household variables considered to be involved in the household locational choice process[2].

Aggregate analyses were undertaken in Part A with a view to identifying and mapping the major dimensions of Christchurch's spatial structure; in particular, its population, housing, homogeneity and vacancy structure. Areas were classified and regionalised according to one or more of these dimensions, thereby providing a major input for modelling undertaken in Part B. In Part B explanatory models were derived at the individual (i.e. household) level, for residential mobility, residence choice and locational choice outcomes. In the section which follows, principal findings from the various sections of the thesis are summarised.

FINDINGS: RESIDENTIAL STRUCTURE AND PATTERN

The analyses of residential structure (Chapters 2 and 3) produced important results in their own right as well as providing necessary input for locational choice models.

A conventional factorial ecology of fourteen indicants of area social and demographic status produced three major dimensions of differentiation: tenure status - life style, youthfulness - old age (or stage in life cycle), and socio-economic status. The principal components/varimax-rotation technique was only one of many available within the general factorial ecology methodology. A range of others were also applied to the population data set, which involved different variable combinations and spatial scales, and various transformations were applied to the variables. Tests for the stability of the three factor solution over all analyses, and also of the spatial pattern of the component scores, indicated that the one presented above was typical of all. Within the constraints of the data set being used, therefore, the social and demographic pattern of Christchurch described in Chapter 2 would seem to be invariant, and not peculiar to the particular set of variables and areas, and to one detailed methodology. The tests for invariance of residential structure and pattern confirmed the robust nature of the principal components - varimax rotation model, firmly establishing its role in subsequent aggregate analyses.

Component analysis of twenty five housing indicators (Chapter 3) generated three dimensions capable of describing variations in Christchurch's housing stock: housing value, housing quality and dwelling type. Together, the dimensions of population and housing structure provide the basic components of an areal framework within which households undertake intra-urban migration.

The structure was not fully specified, however. The 'theory' of residential processes and patterns in 'Western' cities suggests the separation of different social groups into relatively exclusive areas which operate as identifiably separate housing markets. The two factorial ecologies just reported indicate that the trend within Christchurch was for residential separation along the anticipated lines. Factorial ecologies do not, however, indicate the degree of 'exclusiveness' or 'homogeneity' within areas. Without information on these aspects of residential area characteristics, the description of the spatial structure of a city given by factorial ecologies is far from complete, and perhaps not particularly relevant to the uses which might be made of their outputs.

The level of within-area variation on several population and housing attributes was determined for Christchurch's census districts. The data matrix of homogeneity scores was factored, revealing three components labelled as: socio-economic status, life cycle/age structure and housing type. Such a division of the variables conformed very much with the results of the 'classical' factorial ecologies, indicating that there is considerable covariation among the homogeneity scores representing the major axes of urban residential differentiation. From this analysis it is concluded that the different indicants of various residential-area characteristics spatially covary in their homogeneity as well as their intensity. The ability to build measures of within-area and between-area variation into structural locational choice models enhanced both their explanatory and predictive capacity.

The form of the location allocation models developed in the study required a multidimensional classification of Christchurch's residential districts. Employing the population, housing and homogeneity factors listed above, several typologies and regionalisations were generated to provide areal identifiers for destination locations chosen by the mover households.

Since there are many sub-areas of the city which, for certain periods in time, either have no vacant properties whatsoever or else have only a narrow range of property types, a measure of property availability was thought to have an important role in models of locational choice. An assumption of homogenous vacancies was clearly unrealistic; consequently a measure of both vacancy structure and pattern was incorporated in the locational choice models. This refinement was achieved via components analysis of property data extracted from multiple listing cards. Several dimensions, narrower in scope than the general housing dimensions of quality, value and type (identified in Chapter 3), summarised the city's vacancy structure for the period January-October, 1974 (the period in which household mobility behaviour was being modelled).

It was argued that the conceptions or cognitions that most households would hold of the residential areas of their city (or sections of it) are based on the objective population and housing patterns of the type described in Chapters 2, 3 and 5. However, the existing structure was not, in itself, a sufficient basis for modelling household locational choice. Vacancy structure and homogeneity patterns therefore became necessary added descriptors of the city's residential fabric.

FINDINGS: INTRA-URBAN MIGRATION OUTCOMES

Employing data derived from aggregate analyses in Part A and from a sample survey of Christchurch residents, empirical models were established for three intra-urban migration outcomes.

1. Residential Mobility Outcome

The objective of the prospective residential mobility model was to predict, from a group of randomly selected households, those who could be expected to undertake an intra-urban move within some specific time period (in the present case twelve months). The model equation which best summarised the variation in household mover-stayer behaviour and best predicted mobility outcomes is represented symbolically as:

$$M = f\ (E, T, F, D, O, S)$$

where M = move-stay option

E = total events experienced (or likely to be experienced) by household over a specified time period

T = previous tenure

F = stage in family life cycle

D = average duration of residence

O = occupation status of head of household

S = household's level of satisfaction at present location.

The level of successful mover-stayer allocations was in the region of 80 percent, suggesting that most of the major factors associated with the outcome of the residential mobility decision have been identified, quantified and integrated within the framework of an explanatory model.

2. Residence Choice Outcome

Residence choice can be characterised in several ways: as a tenure outcome, as a dwelling type outcome and as an expenditure outcome. In modelling housing expenditure of mover households, the following symbolic equation was derived:

$$D = f(E, H, L, T, C, S)$$

where D = a household's level of demand for housing (represented by anticipated expenditure)

E = household socio-economic status

H = household size

L = loan finance requirement

T = dwelling type preference

C = dwelling condition preference

S = dwelling size preference.

In contrast to the previous model, where life cycle-related factors acted as the principal determinants of the move-stay outcome, indicants of housing expenditure are largely economic in nature, although need-preference factors were significant contributors to overall explanation.

3. Locational Choice Outcome

The objective of a locational choice model is, simply, to explain and predict a mover household's choice of location, given a number of alternative locations within the city to which the household could move. The location allocation models developed in the present study were based on the premise that the existing residential structure of an urban area exerted a major influence in determining the spatial outcome of an intra-urban move. The structural locational choice models, as they have been termed, were developed in line with generalisations which have accumulated from previous mobility studies and with a view to examining the potential of models based on individual behaviour-urban structure linkages.

a) The Basic Model: Allocation of Mover Households Among Area Types.

A series of locational choice models, based on an extension of the Berry and Rees (1969) residential location schema, were formulated on the premise that a household will move to a particular area type (differentiated by aggregate population and housing attributes) on the basis of certain household characteristics (household structure, residential and locational needs and preferences). In essence, the models were concerned with establishing the extent to which *'certain types of households choose, or are forced to live in certain types of area'*.

A linear model was generated with the following structure:

$$L = f\ (P, N, H, R, A, J, V)$$

where L = areal location chosen by mover household

P = level of anticipated expenditure

N = neighbourhood preferences

H = household characteristics

R = residential preferences

A = access preferences

J = journey to work mode

V = area vacancy characteristics.

While all components of the equation contributed to location allocation, some emerged as more important determinants than others. It was evident that the social and economic attributes of households consistently acted as the principal allocation mechanism when changing residence within the city's residential system. Further evidence concerning the principal control mechanisms involved in intra-urban migration emerged when the performance of area population type, area housing type and area population and housing type models was compared. It will be recalled that the level of explained variance associated with the respective models was 76.3, 65.5 and 69.3 percent. If intra-urban migration is seen to occur within constraints imposed by the urban area as well as from within the individual mover household (the premise on which the study was based), then these results would appear to suggest that it is the distribution of social and demographic groups, rather than the distribution of housing which is responsible for directing population movement within our urban system.

b) The Role of Vacancy Structure in Directing Intra-Urban Migrants.

The distribution of vacancies has been advanced as an important factor in directing migration flows within urban areas, yet there had not been a satisfactory test of this hypothesis. The loadings achieved in the discriminant models by vacancy attributes is indicative of their importance in this process. Further evidence of the role of vacancy structure in intra-urban migration models was revealed when the four vacancy measures were removed from the location allocation models: successful placements dropped from 78 percent to 65 percent; and level of explanation declined from 69.3 percent to 54.0 percent

c) The Role of Location in Locational Choice Models

The locational choice models based on area typologies (the basic model) were not, in the strict sense, locational models. Allocation was to area-types, and as is illustrated in Figure 1.1, a move to a particular area type could indicate that the destination location was in any one of several areas within the city. A physical location factor was therefore incorporated in locational choice models by introducing a contiguity constraint in areal classification. The resulting set of 'regions', in a similar manner to the 'types', acted as potential destination areas for the group of mover households who relocated within Christchurch during 1974. A set of variables identical to those employed in the area type models allows comparison of results with the regional allocation model.

The improved level of explanation associated with the latter model is sufficient to indicate that, in addition to an area's population and housing attributes, its location within the urban system is an important additional factor considered by households who change residence within the city.

d) The Effect of Area Heterogeneity on Model Performance.

The form of the location allocation models developed in the present study depended, for a high degree of explanation and prediction, on the degree of mix among population and housing characteristics in the potential destination areas. As such, the greater the heterogeneity of an area, the greater was the potential for households with quite different residential needs to relocate within the same residential unit. In other words, the greater the heterogeneity of residential sub-areas, the greater was the likelihood of misallocating mover households when a structural model was used as a basis for location allocation.

It was thought that this problem could be overcome by 'building-in' a correction for heterogeneity within the model. The result should be an improved level of explanation and prediction when compared with the regional allocation model. The higher order regional allocation model (as it was termed) performed better than the latter model in terms of both explanation (76.0 versus 71.3 percent) and successful placement of households (65 versus 57 percent), confirming the role of area homogeneity in location allocation modelling.

A test of the predictive validity of the locational choice model, whereby two thirds of a sub-sample of mover households were successfully allocated among residential areas in Christchurch is further evidence of the viability of a structural model formulation of household locational choice.

EXTENSIONS

The models developed in the present study, particularly those related to locational choice, have upheld the expectations advanced in the introductory section. However, as the empirical measures of their performance have suggested, there is scope for improvement both in areas of explanation and prediction. To conclude this study comment is advanced on two fronts: empirical extensions and conceptual/theoretical extensions.

a) Empirical Extensions

The set of models generated for residential mobility, residence choice and locational choice outcomes have been linear additive in form. Selection of this type of model derives from the fact that for many social-economic problems (such as intra-urban migration), the linear model, although perhaps not exact, yields a sufficiently close approximation to the true form of the equation that it is not necessary to be concerned with alternative, more complicated models. This is especially true for exploratory studies.

When there is potential for increasing the level of explanation and prediction by an order of 10 to 20 percent, as is now the case with the present range of models, additional steps need to be sought and considered in an attempt to improve model performance. Possibilities include multiplicative models, which can be applied where it is evident that interaction exists between variables; logarithmic models for instances where a predictor variable takes on a wide range of values but where once a certain value has been reached, further increases produce less and less effect on the dependent variable; or polynomial models, to accommodate bivariate relationships which are curvilinear.

It may even prove necessary to embrace new empirical languages for a more fully effective description of outcomes of the intra-urban migration process. Recent developments in this area include boolean analysis, whereby variables may be combined, using the logical operators 'and', 'or', 'implies', 'is equivalent to', and 'not'. Whatever avenue may be chosen in subsequent empirical modelling, it is evident that all will require a clearer and more careful specification of the nature of the relationship which exists between the variables defined for inclusion in a model equation.

b) Conceptual/Theoretical Extensions

Having developed and extended a theoretical framework for modelling residential mobility outcomes, and having achieved a measure of empirical success with the models concerned, there exists a certain measure of inertia in the desire to embrace, at this stage, alternative migration schemas. To a large extent the variety of empirical models outlined in the section above provide an enormous challenge for an explicit, and whenever possible, theoretically-based identification of explanatory variables - and more importantly, a specification of relationships between the variables. It is to this end that subsequent intra-urban migration research should be directed.

NOTES

1 This represented a departure from what was, at the time, a major focus for empirical residential mobility research, namely the geometric models of locational choice.

2 Choice of predictor variables for locational choice modelling was guided by several generalisations which have emerged from the literature on residential location (refer to Chapters 1 and 7).

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APPENDICES

APPENDIX I.1

THE STUDY AREA

Christchurch is in 1976 the largest city in the South Island with a population approaching 300,000 (Figure I.1). In a national context it ranks third to Wellington, the capital (population 307,500) and Auckland the commercial-industrial 'capital' (population 650,000). At the regional level, Christchurch is the principal service centre for the Canterbury Plains, an extensive area of over 43,000 square kilometers devoted principally to mixed farming and sheep rearing.

The city of Christchurch has several distinctive features, the most obvious ones owing much to the flatness of the site (Figure I.2), a feature which has been conducive to a radial extension of the built-up area along the lines proposed by the classical urban growth models (Figure I.3). The Port Hills are a limitation to an extensive southward extension of the urban area, although there has been residential development on several spurs and in some of the valleys - taking advantage of a pollution-free environment and views of city, ocean or Southern Alps.

The original plan of Christchurch had indicated a settlement one square mile in extent, bordered by an area initially reserved as a green belt, but later subdivided and sold as population increased (the exception being Hagley Park to the west of the 'city'). Within the original town belt residential landuse has now, for the most part, given way to the demands of commerce and industry (Figure I.4). Despite the rapid suburbanisation following the second world war, there has been little decentralisation of CBD functions to the suburban centres.

The location of the railway line is an obvious explanation for the industrial pattern of the city. Instead of a concentration around the core, industrial growth has been siphoned off in two directions: to the southeast along the rail link to the port of Lyttelton and to the west to what is now the major industrial suburb of Hornby. The rural areas which fringe Christchurch have offered little resistance over the years to the sprawl of the built-up area[1]. Notwithstanding this continual invasion by urban landuse there is an identifiable

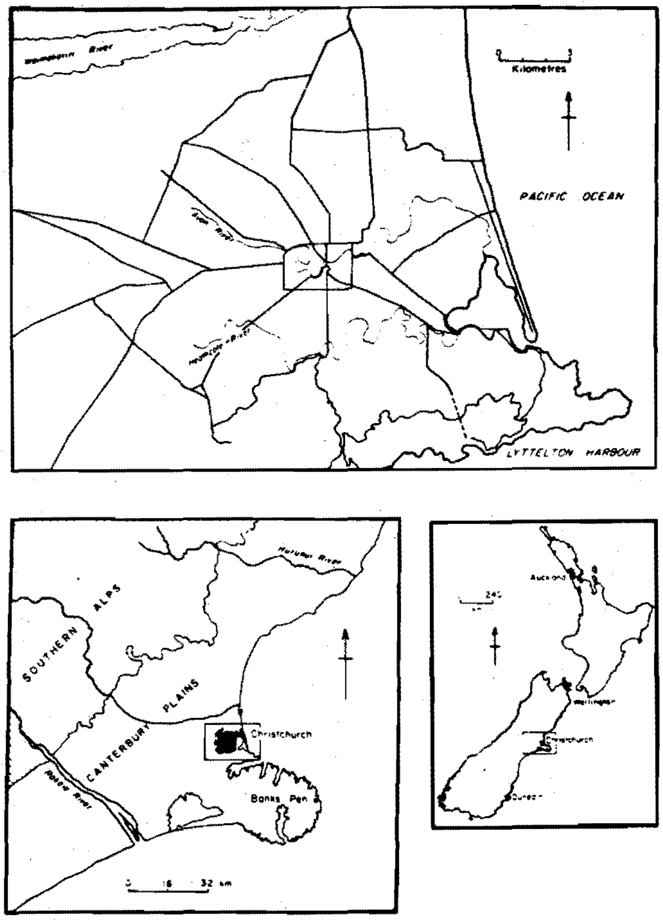

FIGURE I.1 : CHRISTCHURCH : LOCATION MAP

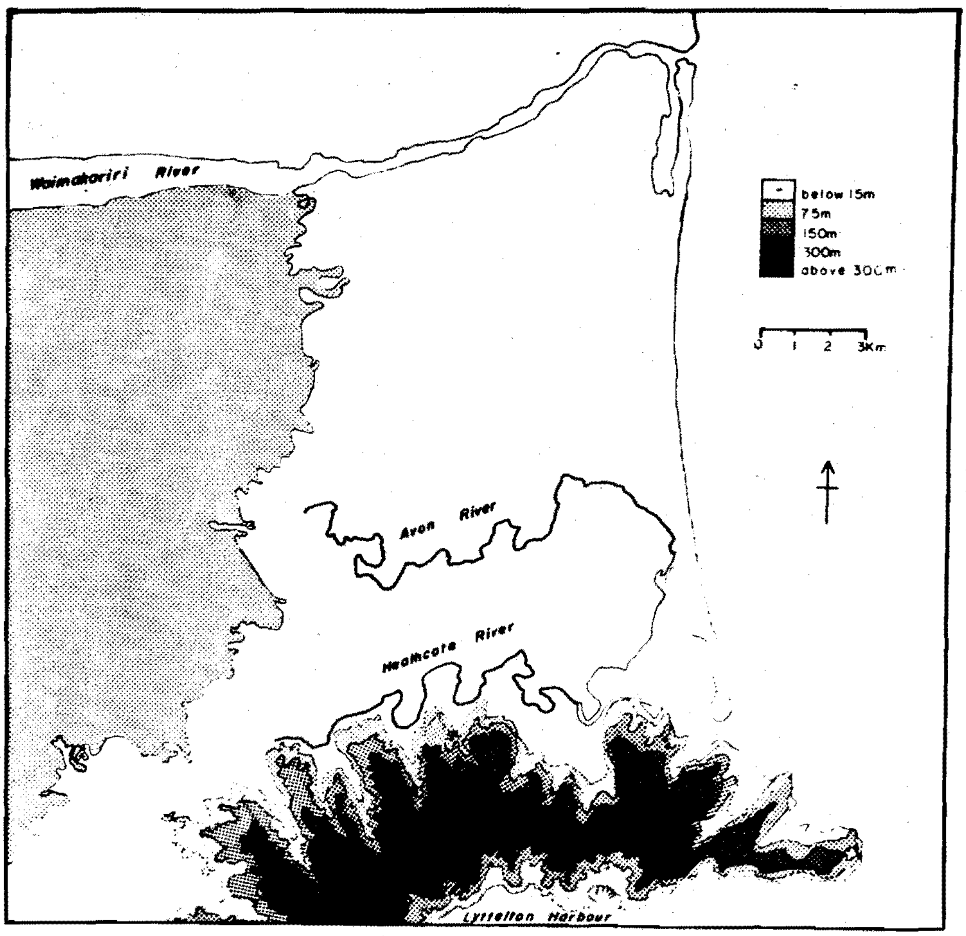

FIGURE I.2 : CHRISTCHURCH : TOPOGRAPHY

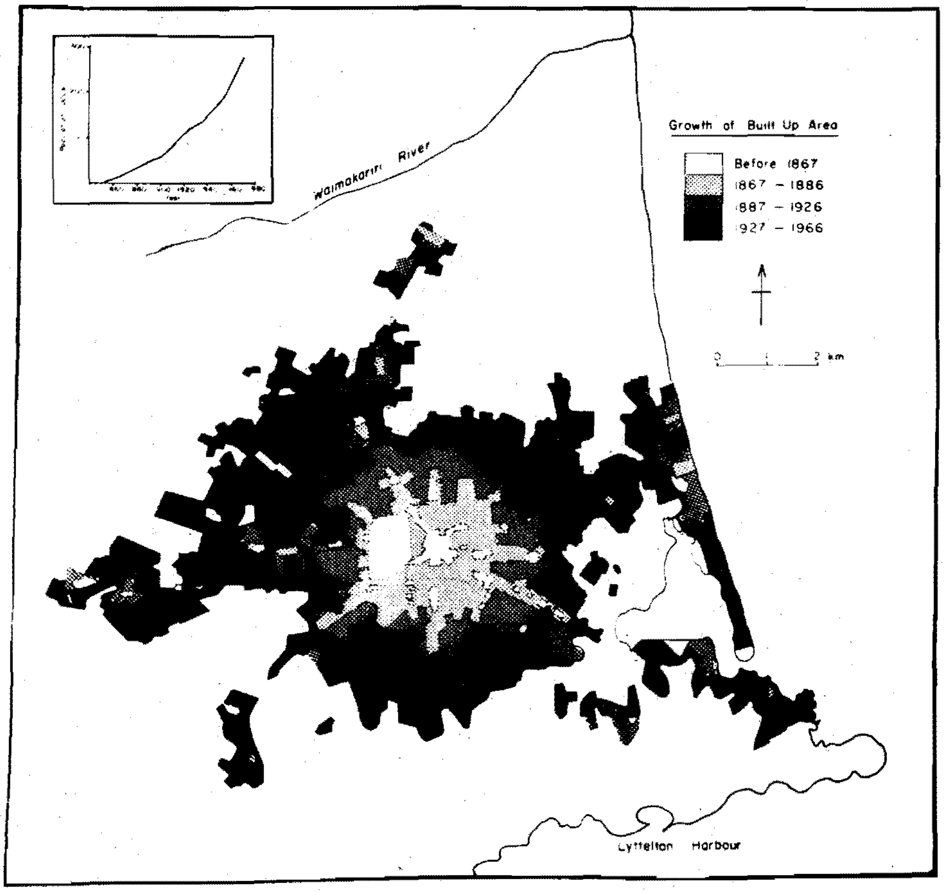

FIGURE I.3 : CHRISTCHURCH : GROWTH OF BUILT UP AREA

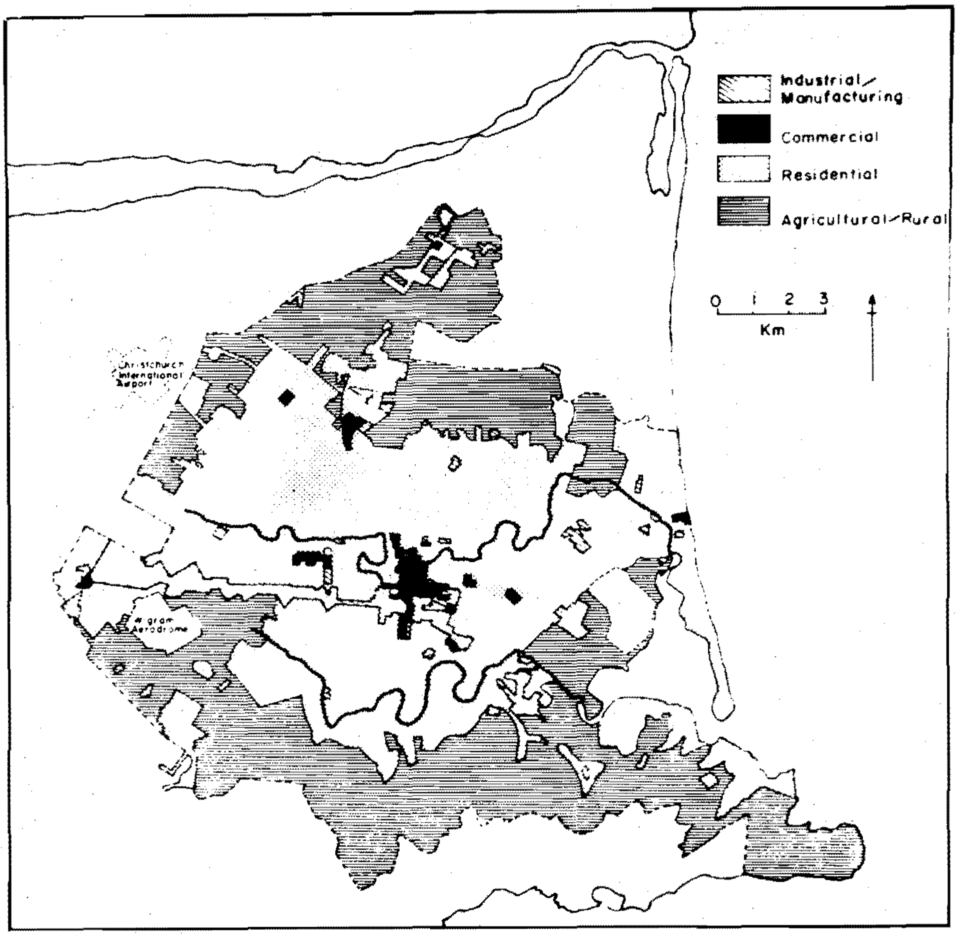

FIGURE I.4 : CHRISTCHURCH : GENERALISED LANDUSE rural-urban fringe around Christchurch. The north and northwest fringe areas are given over for the most part to market gardening, while in the north-facing valleys of the Port Hills the microclimate has led to a high degree of specialisation in horticulture.

The structure and patterning of the residential areas of Christchurch constitute one of the central foci for examination in the present study. Chapters 2-5 will show that the residential fabric is not undifferentiated (as the generalised map of landuse would suggest). Rather, it is composed of several distinct 'types' of sub-area, each one presenting prospective intra-urban migrants with a sub-set of potential destination areas for relocation.

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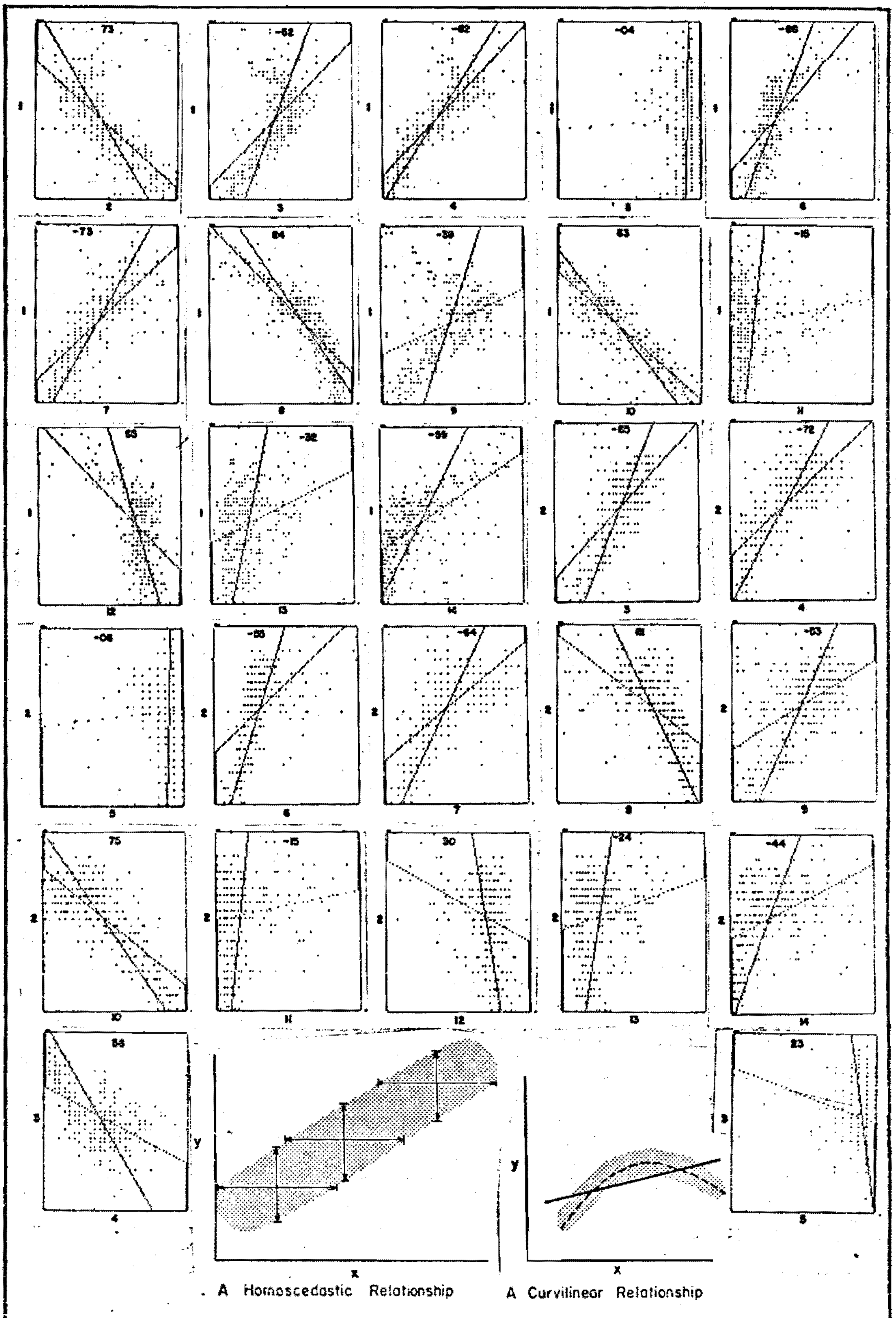
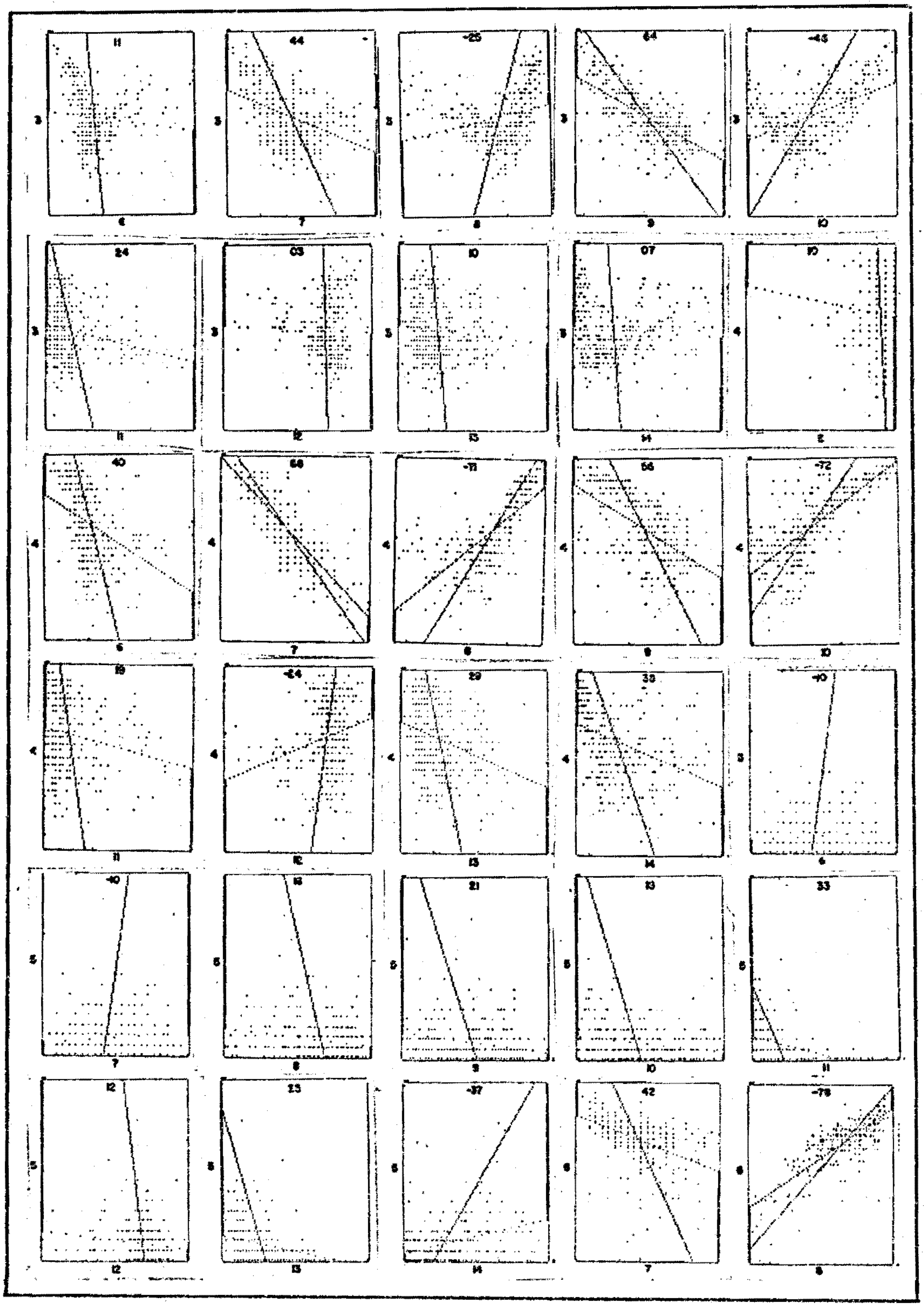
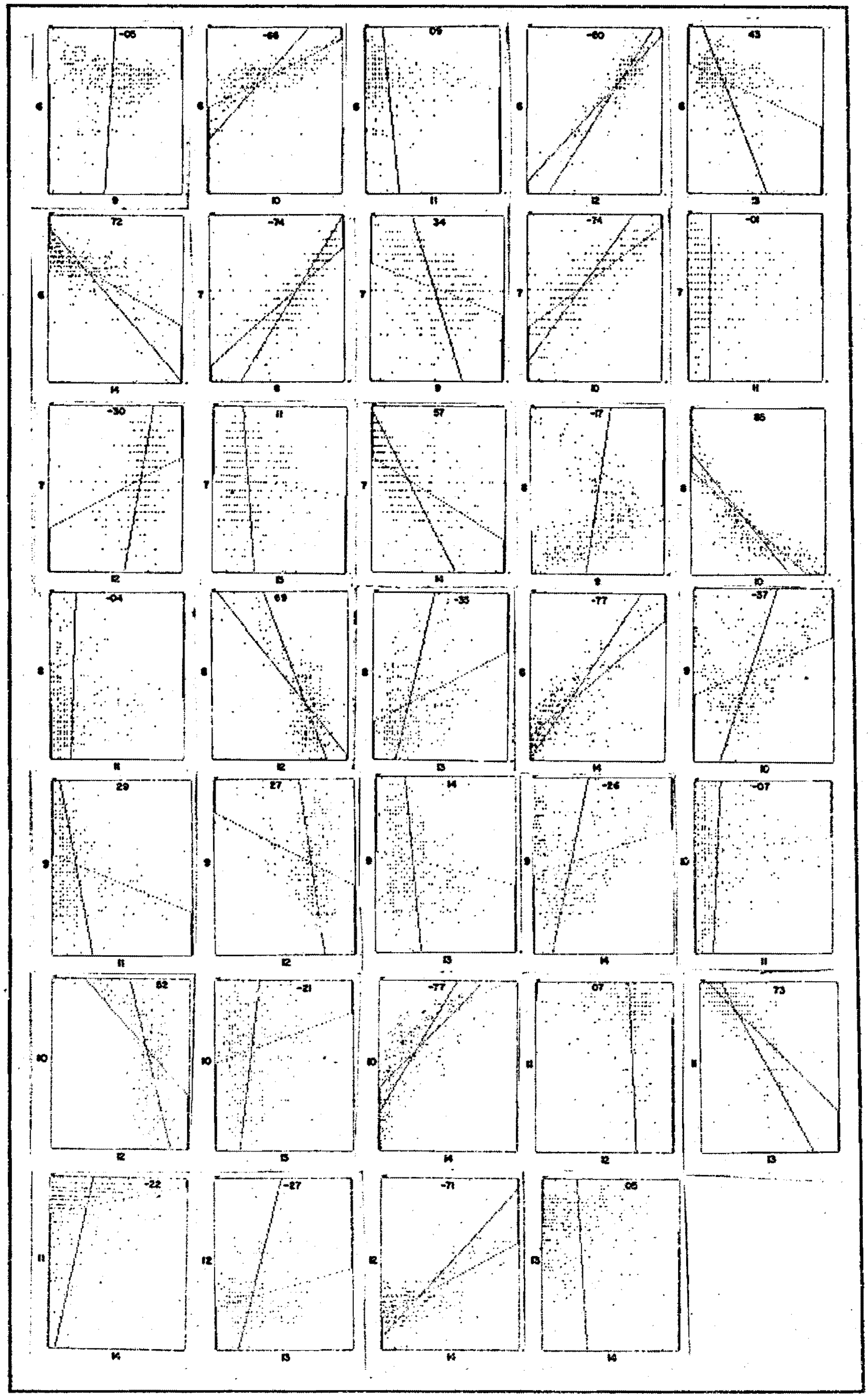
1 Recently, however, the Canterbury Regional Planning Authority, with the co-operation of the Waimairi, Heathcote and Paparua County Councils - the three counties which are in a position to dictate the future development of Christchurch's rural urban fringe - has implemented an 'urban fence' designed as a buffer to further encroachment onto agricultural land.

APPENDIX II.1

SCATTER DIAGRAMS AND LINEAR REGRESSIONS FOR SOCIAL-DEMOGRAPHIC DATA SET







APPENDIX II.2

SAMPLE MESH BLOCK OUTPUT

1971 - MESH BLOCK 017 003 05

2.AGE GPS	0-4	5-9	10-14	S/T1	15	16-19	S/T2	20	21-24	S/T3	25-29	30-34	35-39	40-44	S/T4	45-49	50-54	55-59	60-64	S/T5	65+	TOTAL
MALE	1	0	0	1	0	0	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	3
FEMALE	1	0	0	1	0	1	1	0	0	0	1	0	0	0	1	0	0	0	0	0	0	3
TOTAL	2	0	0	2	0	1	1	0	1	1	1	1	0	0	2	0	0	0	0	0	0	6
NZM-MALE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C
NZM-FEMALE	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NZM-TOTAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

11.NATURE	HOUSE	FLATS	S/T1	TEMP	L-HOTEL	L-MOTEL	MOTEL	P-HOTEL	S/T2	EDUCATN	MEDICAL	RELIG	FORCES	WELFARE	S/T3	TOTAL
DWGS	1	1	2	0	0	0	0	0	0	0	0	0	C	0	0	2
OCCUPANTS																
MALE	1	2	3	0	0	0	0	0	0	0	0	0	C	0	0	3
FEMALE	1	2	3	0	0	0	0	0	0	0	0	0	C	0	0	3
TOTAL	2	4	6	0	0	0	0	0	0	0	0	0	C	0	0	6

3. RACE	TOTAL POP M	TOTAL POP F	NZ MAORI M	NZ MAORI F	SAMOAN M	SAMOAN F	COOK IS M	COOK IS F	TOKELAU M	TOKELAU F	NIUEAN M	NIUEAN F	CHINESE M	CHINESE F	INDIAN M	INDIAN F
AGE 0-14	1	1	0	0	0	0	C	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16-19	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20-24	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-34	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35-44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45-64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65+	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M-ST1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M-ST2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
M-ST3-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

4.INCOME	TOTAL POP MALE	TOTAL POP FEMALE	NZ MAORI MALE	NZ MAORI FEMALE
UP TO 599	1	2	0	0
600-1799	0	C	0	0
1800-2999	0	1	0	0
3000-5999	2	0	0	0
6000+	0	0	0	0
NOT SPEC	0	0	0	0
TOTAL	3	3	0	0

12.COOKING	ELECTRIC	GAS	WOOD	OIL	OTHER	NO MEANS	TOTAL
NOS	2	C	0	0	0	0	2

7.OCCUP ST	EMPLR	O/ACCT	SA/WAG	UNEMP	S/T1	RETIRD	STUD	HWIFE	S/T2	TOTAL
MALE	0	1	1	0	2	0	0	0	0	2
FEMALE	0	C	1	0	1	0	0	1	1	2

13.AMENITIES	WC	TV	PHONE	FRIDGE	D/FREEZE	M/MOWER	E/WASHER	E/DRYER
NOS	2	2	1	2	1	2	2	C

1.RESIDENTS AGE	MALES 0-14	15-24	25-44	45-64	65+	S/TM	FEMALES 0-14	15-24	25-44	45-64	65+	S/TF
USUAL RES	1	1	1	0	0	3	1	1	1	0	0	3
OTHER NZ	0	0	0	0	0	0	0	0	0	0	0	0
OSEAS	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	1	1	1	0	0	3	1	1	1	0	0	3

G/T	9.OCCUPATION	1	2	3	4	5	6	7	8	9	0	TOTAL
6	MALE	0	1	0	0	0	0	1	0	0	0	2
0	FEMALE	0	0	1	0	0	0	0	0	0	0	1
0	TOTAL	0	1	1	0	0	0	1	0	0	0	3
	NZM-MALE	0	0	0	0	0	0	0	0	0	0	0
6	NZM-FEMALE	0	0	0	0	0	0	0	0	0	0	0
	NZM-TOTAL	0	0	0	0	0	0	0	0	0	0	0

5. NOD FAMILY	01-06 ONE	ONE+	MULTI HOUSEHOLD TWO	TWO+	THREE+	NONE	ONE PERSON USL	TEM	TOTAL H-H
NOS	2	0	0	0	0	0	0	0	2

6.DIABETES	TOTAL POP MALE	TOTAL POP FEMALE	NZ MAORI MALE	NZ MAORI FEMALE
NOS	0	C	0	0

10.TRANSPORT	PRIV	PR-PASS	BUS	TRAIN	B/MCYCLE	WALK	BOAT	AT-HOME	OTHER	TOTAL
MALE	1	0	0	0	0	0	0	1	0	2
FEMALE	1	0	0	0	0	0	0	0	0	1

8.INDUSTRY	1	2	3	4	5	6	7	8	9	0	TOTAL
MALE	0	0	0	0	1	0	1	0	0	0	2
FEMALE	0	0	0	0	0	0	C	0	1	0	1

14.TENURE	RENT/LEASE	FREE	LOAN	NO-MORG	B-TMORG	B-FMORG	TOTAL
NOS	2	0	0	0	0	0	2

15.CAR OWNERSHIP	NO-CAR	CAR		NO-CAR	CAR		NO-CAR	CAR
PRIVATE	1	1	BUSINESS	1	1	BOTH	0	2

APPENDIX III.1

SAMPLE LISTING FROM VALUATION MASTER FILE

VALUATION DEPARTMENT - LAND USE DATA LISTING 20 SEP 73 PAGE 70

ROLL 2345 PAPANUA COUNTY REVISED 1 JUL 72 RATING SYSTEM CV

ASSMT	MESH NO	HSL NO	STREET	LV	VI	AREA	ZONE	USE	UNITS	SS	G/P	AGE	CND	CST	SCOR	F/A
1		20	HADSONS LANE	3300	8200	0-0-28.50	9A	91	1		1	5	AA	BT	11	11
2		25	HAYNES AVE	3300	8200	0-0-31.50	9A	91	1		1	5	AA	BT	11	11
3		23	HAYNES AVE	2850	6250	0-0-28.00	9A	91	1		1	1	AA	FT	10	10
4		21	HAYNES AVE	4100	6900	0-0-36.90	9A	91	1			5	AA	MT	6	13
5		19	HAYNES AVE	3100	7300	0-0-36.90	9A	91	1			5	AA	MT	7	18
6		17	HAYNES AVE	3100	7500	0-0-30.80	9A	91	1		1	5	AA	FT	13	13
7		15	HAYNES AVE	2750	6150	0-0-26.70	9A	91	1		2	5	AA	BT	11	11
8		11	HAYNES AVE	3800	15200	0-1-08.60	9A	41	1	5		5	AA	BI	21	21
9		9	HAYNES AVE	2750	6350	0-0-26.70	9A	91	1			5	AA	MT	11	11
10		7	HAYNES AVE	2700	6200	0-0-26.20	9A	91	1			5	AA	MT	11	11
11		5	HAYNES AVE	2550	6250	0-0-24.30	9A	91	1		1	5	AA	MT	9	9
12		3	HAYNES AVE	2550	6450	0-0-24.30	9A	91	1		1	5	AA	MT	10	10
13		1	HAYNES AVE	3150	6150	0-0-29.00	9A	91	1			5	AA	MT	11	11
14		24	BALLANTYNE AVE	2750	6450	0-0-26.20	9A	91	1			5	AA	MT	11	11
15		26	BALLANTYNE AVE	2750	9050	0-0-27.50	9A	91	1		2	5	GS	MT	11	11
16		28	BALLANTYNE AVE	2750	8250	0-0-26.30	9A	91	1		2	5	AA	MT	11	11
17		30	BALLANTYNE AVE	2750	6350	0-0-26.60	9A	91	1		1	5	AA	MT	10	10
18		32	BALLANTYNE AVE	2850	6250	0-0-35.40	9A	91	1			5	AA	BT	11	11
19		34	BALLANTYNE AVE	2850	7150	0-0-32.20	9A	91	1			5	AA	BT	11	11
20		33	BALLANTYNE AVE	2550	7150	0-0-34.10	9A	91	1			5	AA	BT	11	11
21		31	BALLANTYNE AVE	2850	8450	0-0-38.90	9A	91	1			5	AA	BT	12	12
22		27	BALLANTYNE AVE	2850	8450	0-0-29.00	9A	91	1		1	5	AA	CT	11	11
24		25	BALLANTYNE AVE	2850	6150	0-0-28.90	9A	91	1			5	AA	FT	11	11
25		23	BALLANTYNE AVE	2850	7150	0-0-27.90	9A	91	1		1	5	AA	MT	13	13
26		21	BALLANTYNE AVE	3000	6500	0-0-32.70	9A	91	1			5	AA	BT	11	11
27		19	BALLANTYNE AVE	2600	10400	0-0-24.00	9A	91	1		1	5	AA	BI	11	11
28		17	BALLANTYNE AVE	2850	7550	0-0-28.50	9A	91	1		1	5	AA	BT	11	11
29		15	BALLANTYNE AVE	2600	7600	0-0-24.70	9A	91	1		1	5	AA	BT	11	11
30		13	BALLANTYNE AVE	2600	4300	0-0-24.20	9A	91	1		1	5	AA	FT	9	9
31		11	BALLANTYNE AVE	2600	7200	0-0-24.10	9A	91	1		2	5	AA	FT	10	10
32		9	BALLANTYNE AVE	3100	8600	0-0-27.50	9A	91	1		1	5	AA	MT	13	13
33		25	OWENS ST	2800	6400	0-0-32.20	9A	91	1		1	5	AA	MT	9	9
34		23	OWENS ST	2800	7000	0-0-32.10	9A	91	1		1	5	AA	MT	12	12
35		21	OWENS ST	2800	7500	0-0-32.10	9A	91	1		1	5	AA	MT	12	12
36		19	OWENS ST	2600	8500	0-1-19.60	9A	91	1		1	5	AA	CI	12	12
37		19	OWENS ST	2700	8600	0-1-29.50	9A	91	1		2	5	AA	MT	13	13
38		19	OWENS ST	2600	6600	0-2-06.60	9A	91	1			5	AA	MT	11	11
39		17	OWENS ST	2800	7500	0-0-32.10	9A	91	1		1	5	AA	MT	12	12
40		15	OWENS ST	2800	7800	0-0-32.10	9A	91	1		1	5	AA	MT	12	12
41		13	OWENS ST	2800	7600	0-0-32.10	9A	91	1		1	5	AA	MT	12	12
42		11	OWENS ST	2800	8800	0-0-32.10	9A	91	1		1	5	AA	MT	12	12
43		9	OWENS ST	2800	7800	0-2-38.60	9A	91	1		2	5	AA	MT	12	12
44		9	OWENS ST	2900	7100	0-2-26.00	9A	91	1			5	AA	MT	12	12
45		7	OWENS ST	2800	8700	0-0-32.10	9A	91	1		1	5	AA	MT	14	14
46		5	OWENS ST	2800	7500	0-0-32.10	9A	91	1		1	5	AA	MT	11	11
47		23	CURLETTS RD	3850	1450	0-0-31.60	9A	91	1			1	AA	RI	8	8
48		21	CURLETTS RD	3850	2150	0-0-38.70	9A	91	1		1	1	AA	RI	9	9
49		19	CURLETTS RD	3800	9200	0-0-35.20	9A	92	2		1	4	AA	MT	17	17
50		17	CURLETTS RD	2000	3000	0-0-38.80	9A	81	1			5	AA	CI	8	8
51		15	CURLETTS RD	3650	2150	0-0-33.70	9A	91	1			1	AA	MI	10	10
52		13	CURLETTS RD	5000	3000	0-0-28.20	9A	81	1			5	AA	CI	8	8
53		11	CURLETTS RD	3500	7400	0-0-24.00	9A	91	1		1	5	AA	CT	9	9
54		9	CURLETTS RD	3500	35500	0-1-17.30	9A	92	5		5	6	AA	CT	41	41
55		9	CURLETTS RD	6000	32000	0-0-19.80	9A	92	4		4	6	AA	CI	33	33
56			CURLETTS RD	7500	58500	0-1-39.30	9A	92	11			6	AA	CI	65	65
57		7	CURLETTS RD	4500	40500	0-0-39.80	9A	92	4		4	6	AA	BI	32	32
58		7	CURLETTS RD	6750	27250	0-0-36.00	9A	92	3		3	6	AA	CI	38	38
59		5	CURLETTS RD	4400	4800	0-0-36.30	9A	91	1		1	3	AA	RI	12	12
60		3	CURLETTS RD	4800	6600	0-0-36.30	9A	91	1		2	4	AA	MT	10	10
61		43	MAIN SOUTH RD	5700	7400	0-0-35.40	9A	91	1		1	4	AA	RT	12	12

APPENDIX III.2

INDEX OF QUALITATIVE VARIATION - SENSITIVITY TESTS

A. NUMBER OF CATEGORIES

a)	[10 , 30 , 15 , 20 , 15 , 10]	IQV = 93
b)	[40 , 35 , 25]	IQV = 100
c)	[55 , 45]	IQV = 99
d)	[70 , 19 , 6 , 5 , 0 , 0]	IQV = 54
e)	[89 11 , 0]	IQV = 30
f)	[95 , 5]	IQV = 19

B. DISTRUBTION OF VALUES AMONG CATEGORIES

g)	[100 , 0 , 0]	IQV = 0
h)	[99 , 1 , 0]	IQV = 3
i)	[95 , 5 , 0]	IQV = 15
j)	[95 , 3 , 2]	IQV = 15
k)	[90 , 10 , 0]	IQV = 28
l)	[90 , 5 , 5]	IQV = 28
m)	[60 , 30 , 3 , 2 , 3 , 2]	IQV = 63

a MLS : Single Family Detached Properties

Address	District	Zone	Facing	Area of Land	Phone	Date	Listing No.
21 Waiwetu Street	Fendalton	9	N	30P	517 356	5/12/73	T12/83

Type Bung. | Walls R/C/Br. | Roof Tile | Piles L & P | No. Rooms 6+k | Age approx 25 | AV

Lounge 18' x 12' OFP drs to sunroom
Living
Dining 15' x 9'6" OFP
Kitchen 10' x 12' SSB
Sun Room off diningroom 11' x 9'
Bed 1 13' x 12' DBIR
Rms 2 12' x 12'
3 10' x 9'6" DBIR
4
Bathroom 9' x 7' BIB SC Basn.
Laundry 6' x 6' SST
Hot W/service El. Dual Toilet Int/Ext Int.
Garage 18' x 12'
Outbuildings Nil/
Title Ref. Lot 3 D.P. 11023
CT 483/56 RS60 Rates $ 176.32

Water HP
Cooker EL AUTO
Sewer YES
Paths GRAVEL
Fencing LIVE
Buses CLOSE
Shops "
Price $ 34,500
Mort.
G.V. U $ 7,000
I $ 7,000
Cap $ 14,000

Owner/Occupier
Dr & Mrs J.F. Burrows
If vacant Owner's Address
Vendor's Solicitor
Hensley & Mortlock
Listing Agent Royds Real Estate

Waiwetu Street is an exceptionally popular street and there will be few chances to buy such a delightful permanent material home in this situation. Picturesque, valuable section with stream boundary. Public Valuers report at $36,000 can be inspected.

Chattels incl. in price are: F.F.C. window coverings, bathroom heater & mirror, panel heater

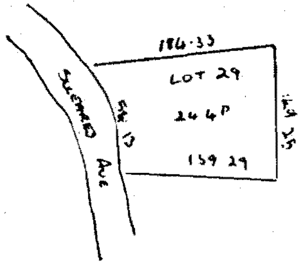
Inspection Please 'phone first - back dr key under back dr mat

$ 34,500	21 Waiwetu Street	Fendalton	9	T12/83

b MLS : Sections (Building Lots)

Address	District	Zone	Facing	Area of Land	Phone	Date	Listing No.
[illegible] Soleares Avenue	Mt Pleasant	16	N	24.4P	63 649 B 74 317 P	[illegible]	[illegible]

Type [illegible]
Water HP
Sewer YES
Fencing
Buses/Shops 3mins/5mins
Price $ 15,250
Mortgage
Govt. V. $ 4,000
Valn. L. $
Cap. $ 4,000
Title Ref. Lot 29 D.P.28684
C.T. Rates $ 111.44
Owner
Mrs J. M. Sinclair
Owners Address



Vendors Solicitor
Brockett, Cameron & O'Railly
Listing Agent Warwick Todd Ltd.
Inspection

Expansive city and mountain views.
Excellent building site.

$ 15,250	163 Soleares Avenue	Mt Pleasant	16	[illegible]

c MLS : Ownership Flats

Address	District	Zone	Facing	Area of Land	Phone	Date	Listing No.
73 Springfield Road	St Albans	2	E	35.1P	389 588	11/12/73	T12/88

Type O/B Flat 4 | Walls Block | Roof Monier | Piles G.B. | No. Rooms 3+k | Age approx New | AV

Lounge 16' x 13' Ranch slider
Living
Dining) 12' x 10' FB SSS
Kitchen)
Sun Room off
Bed 1 12' x 11' DBIR
Rms 2 11' x 8' "
3
4
Bathroom BIB VU
Laundry SST
Hot W/service El. Toilet Int/Ext Int.
Garage 20' x 10'
Outbuildings
Title Ref. pt Lot 1 D.P. 10709
C.T. Rates $

Water HP
Cooker EL.
Sewer YES
Paths CONC.
Fencing PAL.
Buses 1 MIN
Shops "
Price $ 18,500
Mort.
G.V. U $
I $
Cap. $

Owner/Occupier
Mr B.J. Jackson
If vacant Owner's Address:
17 Domain Terrace
Vendor's Solicitor:
Cavell, Leitch, Pringle & Boyle
Listing Agent: W. E. Simes

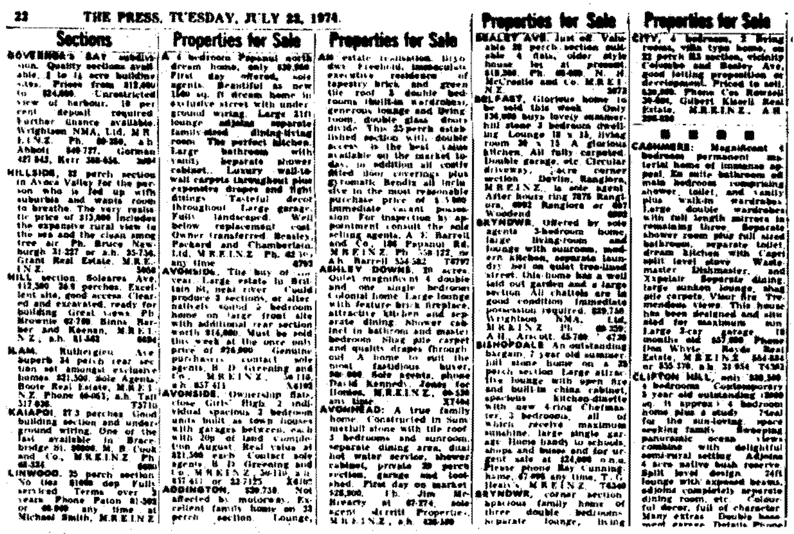
Superior, luxury unit, fully insulated, mahogany interior doors, high quality finish.

Chattels incl. in price are:

Inspection Anytime

$ 18,500	73 Springfield Road	St Albans	2	T12/88

d Classified Advertisements


22 THE PRESS, TUESDAY, JULY 23, 1974.

Sections | Properties for Sale | Properties for Sale | Properties for Sale | Properties for Sale

APPENDIX IV.2

THE STRUCTURE OF NEWSPAPER ADVERTISEMENTS FOR VACANT PROPERTY: CHRISTCHURCH, 1974

The present section represents an addition to Chapter Four in which the vacancy data drawn from advertisements in the local newspaper is briefly examined and contrasted with that from MLS listings.

A newspaper which appears six days per week generates an enormous amount of information regarding properties entering the market. The problem becomes one of finding an objective method which can be used to quantify relevant attributes appearing in the content of advertisements. A technique which satisfies this requirement is quantitative content analysis[1]. Content analysis is a technical procedure for producing data, not a methodology for manipulating quantitative materials. As such it is a technique which uses the frequency of occurrence of a certain content characteristic (e.g. a word, phrase, theme) as the basis of measurement. What content is analysed and what specific coding procedures are used relates to the particular purpose of the investigation. For the present study, the housing, site and neighbourhood indicators listed in Appendix IV.3 represent a comprehensive checklist for scanning the content of advertisements of vacant property. Every occurrence of a specified indicator is tallied.

Finally, some form of sampling is required which narrows the relevant source data to manageable proportions but provides an accurate representation of the nature of property advertised within the Christchurch Urban Area in 1974. The following sampling decisions were made:

1) the Saturday editions of the Christchurch Press for the period January-October, 1974

---

1 An account of the development of content analysis, its various operational procedures and its areas of application can be found in Berelson (1952), Pool (1959), and Holsti (1968); and in the geographical literature by Catchpole et. al. (1970), Newton (1971, 1975b) and Moodie (1971).

were chosen as the source of data for content analysis since this edition provides the most comprehensive listing of vacant dwellings;

2) one Saturday issue per month was randomly selected for analysis; and

3) for each of the ten editions selected, the entire section devoted to advertising houses for sale was analysed.

In all, over 2700 advertisements were subjected to content analysis, generating date for the 38 x 55 (attribute x suburb) matrix.

Principal axes analysis was undertaken on this matrix of frequency data. Seven components were extracted, accounting for over 80 percent of the variation in the data. Again, it is evident that a set of vacancy submarket types similar to those isolated when MLS data was employed have emerged (see Table IV.1). These submarkets summarise the major types of housing available in the city, namely: prestige homes; ownership flats; medium price, post 1945 housing; low priced property; and older (pre-1945) housing.

The point of departure of the newspaper-based vacancy submarket structures from those based on MLS listings rests largely on the magnitude of comparable components. The priorities assigned by real estate agents to vacant property are clearly reflected in the structure of the newspaper advertisements. Not only do 'prestige properties' receive a disproportionately large number of advertisements in relation to the number actually on the market, but additionally their attributes are extensively documented. Similar comments hold for the newly built ownership flats and to a certain extent, for some of the better positioned, good quality, post 1945 housing. Property which falls into one of the abovementioned categories is relatively easy to sell and in addition, commands a higher commission. Consequently, it is in the best interests of the real estate agent to remain the sole agent and extensively publicise such houses which are available. Property which proves more difficult to sell (older and poorer quality housing in less desirable areas) while remaining 'on the books' of one or more estate agents is not advertised at the same intensity.

TABLE IV.1

STRUCTURE OF NEWSPAPER ADVERTISEMENTS
FOR VACANT PROPERTY
CHRISTCHURCH, JAN-OCT 1974 *

VARIABLES	COMPONENTS 1.	2.	3.	4.	5.	6.	7.	H^2
$30-35000	76							81
$35-40000	88							94
$40-45000	92							90
$45-50000	90							85
>$50000	96							95
4 BEDROOMS	86							92
>1 GARAGE	69		-55					96
<5 YEARS OLD	50							83
>35 PERCHES	63							74
STREAM BOUNDARY	67			-59				90
SUNNY	68							90
PRIVATE	65							80
TREE SETTING	64			-52				86
INTERIOR DESIGN	64	60						97
OWNERSHIP FLAT		74						88
$15-20000		58			65			86
$20-25000		77						85
$25-30000		52	-56					88
2 BEDROOMS		79						92
1 GARAGE		87						83
NEW		67						82
20-35 PERCHES		57	-54					85
CLOSE TO TRANSPORT		53						83
CLOSE TO SHOPS		61						86
3 BEDROOMS			-72					94
BRICK			-69					86
POST 1945			-77					82
REAR SECTION			-76					69
CUL-DE-SAC			-55	55				81
CLOSE TO SCHOOLS			-55				50	87
QUIET			-67				50	90
<$15000					80			72
CLOSE TO CBD					77			62
<20 PERCHES						78		70
RURAL ATMOSPHERE						-52		50
WEATHERBOARD							54	79
PRE 1945							69	54
VIEWS								53
CUM. % VARIATION	26	44	59	63	70	75	82	
EIGENVALUE	17.6	5.0	2.9	1.8	1.5	1.3	1.2	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS
LOADINGS OVER 50 INCORPORATED IN TABLE
ANALYSIS BASED ON FREQUENCY DATA

COMPONENT LABEL :

1. PRESTIGE HOMES
2. OWNERSHIP FLATS
3. MEDIUM PRICE,POST 1945 HOUSING
4. SITE ATTRIBUTES
5. LOW PRICED,INNER CITY PROPERTY
6. SIZE OF SECTION
7. PRE 1945 HOUSING

APPENDIX IV.3

DATA CODING SHEET FOR CONTENT ANALYSIS

SUBURB: PERIOD:

VARIABLES	FREQUENCY	TOTAL	%
OWNERSHIP FLAT			
<$15,000			
$15,000 - $19,999			
$20,000 - $24,999			
$25,000 - $29,000			
$30,000 - $34,999			
$35,000 - $39,999			
$40,000 - $44,999			
$45,000 - $49,999			
> $50,000			
BEDROOMS: 2			
3			
4			
GARAGE SPACES: 1			
> 1			
BRICK, STONE, CONCRETE			
WEATHERBOARD			
OTHER MATERIAL			
AGE: NEW			
<5 YEARS			
POST 1945			
PRE 1945			
SECTION : SMALL (< 20P)			
AVE (20 - 35P)			
LARGE (> 35P)			
REAR SECTION			
CUL-DE-SAC			
CLOSE TO TRANSPORT			
" " SCHOOLS			
" " SHOPS			
" " C.B.D.			
VIEWS			
STREAM BOUNDARY			
QUIET			
SUNNY			
RURAL ATMOSPHERE			
PRIVATE			
TREE SETTING			
INTERIOR DESIGN MENTIONED			
ADVERTISED PROPERTY			

APPENDIX V.1

PATTERNS OF ACCESS AND JOURNEY TO WORK WITHIN THE CHRISTCHURCH URBAN AREA

The pattern of differential access within Christchurch is partially examined in terms of two area attributes:

1) distance to CBD and general accessibility to the city as a whole, and
2) the journey to work mode of census district residents.

Four variables are involved in the analyses:

1) Distance to CBD. This variable was assessed as the shortest route, by road, from the centre of a census district to the peak value intersection in the CBD. Additional indices, such as travel time to the CBD by private and public transport (see Figures V.1 and V.2) were highly correlated with the road distance measure, as well as with each other. They were not retained for further analysis.

2) Relative Accessiblity. The measure of relative accessibility of a census district within Christchurch is given as the average time taken to travel from that census district to all other census districts within the urban area. This is but one of several measures of relative accessiblity currently in use (see Kirkby, 1969).

   The base data for this measure derives from two 105 x 105 travel time (both public and private transport) matrices generated by the Christchurch Regional Planning Authority. Both matrices give, for all 105 nodes (see Figure V.3), the average travel time to each of the remaining 104 nodes (see Christchurch Regional Planning Report 166 for further details). A measure of the relative accessiblity of each node within the urban area was thereby derived as the average travel time (by public and private transport) to all other nodes within the city. Relative accessibility values for each census district were subsequently derived by extrapolation.

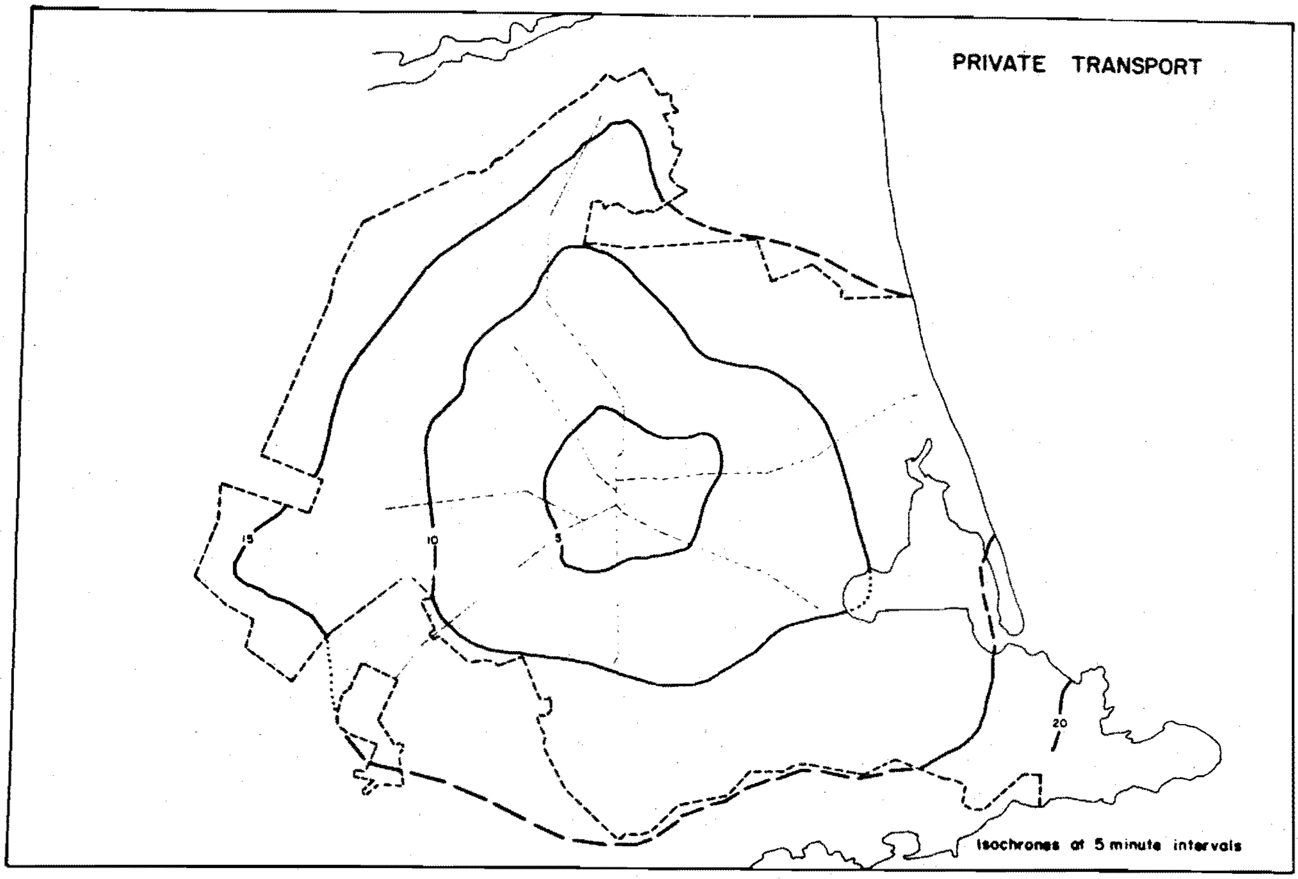


FIGURE V.1 : TRAVEL TIME TO CBD,
PRIVATE TRANSPORT

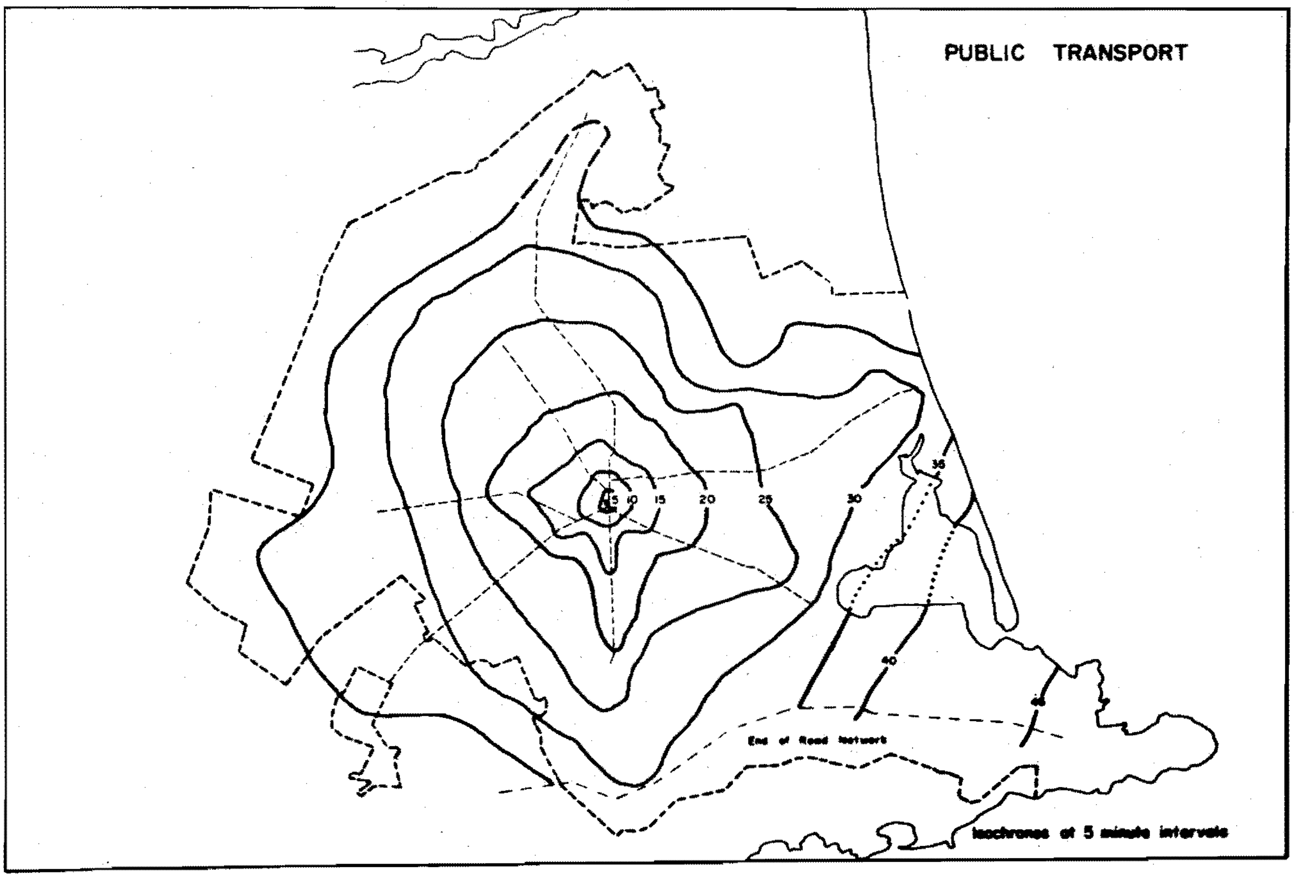


FIGURE V.2 : TRAVEL TIME TO CBD,
PUBLIC TRANSPORT

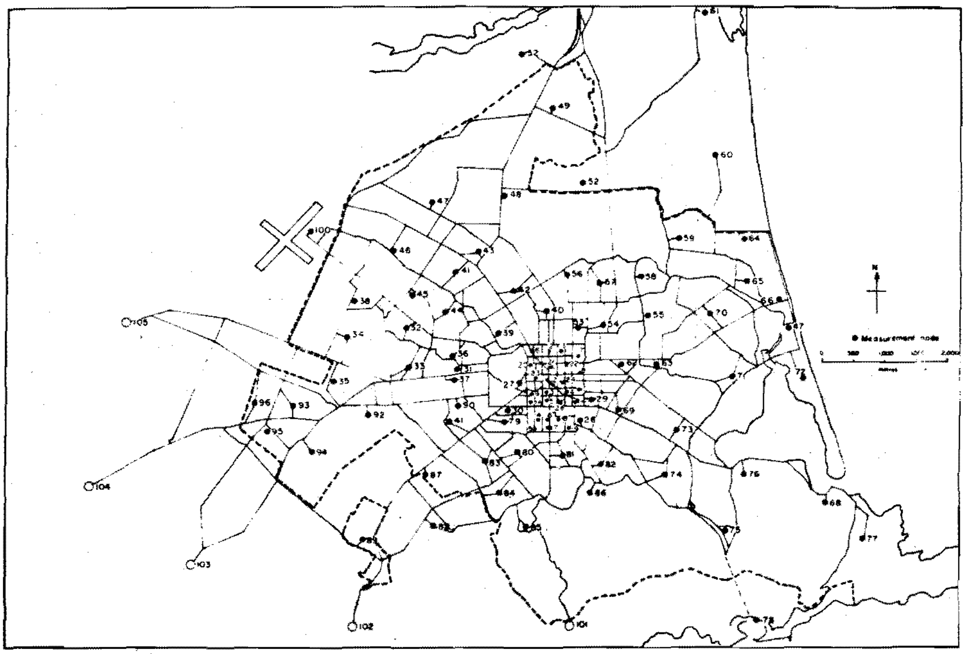


FIGURE V.3 : LOCATION MAP OF CHRISTCHURCH
RPA MEASUREMENT NODES

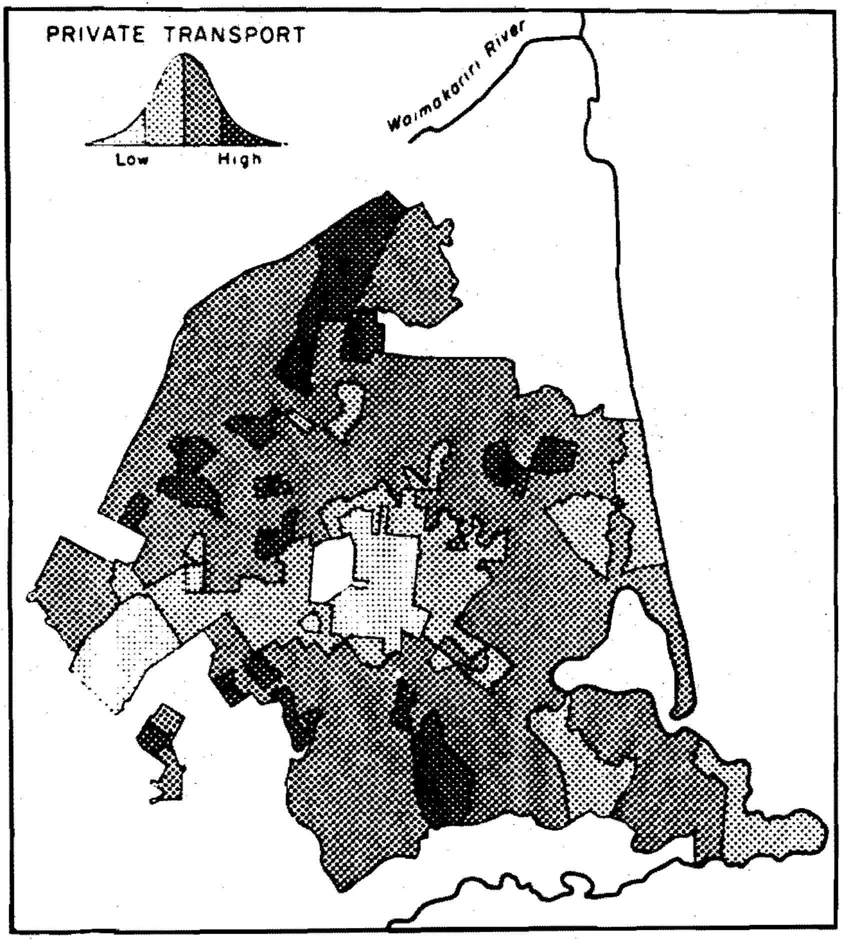


FIGURE V.4 : CHRISTCHURCH : PRIVATE TRANSPORT MODE

3) Car Ownership. Indexed by the percentage of households in a census district who owned one or more cars.
4) Journey to Work. Five categories are available for representing the journey to work mode chosen by the working population of a census district. These are: drive private car, walk, passenger in private car, bus, cycle.

The intercorrelation matrix depicted in Table V.1 indicates that a certain degree of collinearity exists between 'distance to CBD' and 'C.D's relative accessibility', suggesting that for Christchurch at least, location close to the centre of the city facilitates access to most of the surrounding areas. The correlations between 'distance to CBD', 'drive car', and 'car ownership' also suggests that car ownership is at least a co-requisite for living in the outer suburbs; that the closer an area is to the centre, the greater is the likelihood that resident workers may prefer to adopt an alternative form of transport to work.

When this intercorrelation matrix is factored (Table V.2), the resulting components identify the major aspects of Christchurch's access and journey to work structure. This varimax-rotated structure includes a dimension related to the role of private transport with increasing distance from the centre of the city; a dimension which identifies vehicle sharing and public transport as a composite grouping; and a dimension which indexes the general accessibility of census districts within the city.

The walk-drive polarisation in the first dimension is reflected in Figure V.4, with the residential areas surrounding the major employment centres accounting for a greater than average proportion of working residents who walk to work. Such areas include the suburbs which are adjacent to the central commercial district (St. Albans, Linwood and Riccarton), the industrial suburbs of Sydenham, Waltham, Woolston, Sockburn and Hornby, and the outer commercial and industrial centres around Sumner, New Brighton, Aranui and Papanui.

TABLE V.1

CORRELATIONS BETWEEN
ACCESSIBILITY AND JOURNEY-TO-WORK
VARIABLES

1. DRIVE CAR TO WORK	100							
2. PRIVATE PASSENGER	17	100						
3. BUS TO WORK	15	22	100					
4. CYCLE TO WORK	-35	-11	03	100				
5. WALK TO WORK	-84	-30	-42	06	100			
6. CAR OWNERSHIP	86	07	-02	-24	-70	100		
7. DISTANCE TO CBD	59	17	-01	-32	-46	63	100	
8. CD'S REL.ACCESS	43	09	01	-33	-32	43	85	100

TABLE V.2

ACCESS AND JOURNEY-TO-WORK STRUCTURE
CHRISTCHURCH 1971 *

VARIABLE	COMPONENT 1.	2.	3.	h^2
% DRIVE PRIVATE CAR	90			89
% WALK TO WORK	-88			93
% CAR OWNERSHIP	89			87
DISTANCE TO CBD	55		72	82
% PRIVATE PASSENGER		78		70
% BUS TO WORK		75		66
% CYCLE TO WORK			-73	53
RELATIVE ACCESS			77	73
CUMULATIVE % VARIANCE	36	53	77	

* VARIMAX ROTATED PRINCIPAL COMPONENTS ANALYSIS

COMPONENT LABEL

1. PRIVATE TRANSPORT TO WORK
2. PASSENGER TRIPS
3. RELATIVE ACCESSIBILITY WITHIN CHRISTCHURCH

The spatial pattern displayed by the second dimension (Figure V.5) identifies a zone to the north, northwest and west of the centre of the city where a significantly large proportion, generally amounting to a quarter or more of the working population, choose a private passenger or public transport travel mode to work. Residential areas adjacent to the major transport arteries have, as might be expected, higher proportions of residents who use public transport (e.g. Papanui - Main North Road, Harewood Road, Riccarton and Blenheim Roads, Barrington Street, Ferry Road and its extension along the peninsula). The concentric patterning associated with the spatial distribution of component scores from the third dimension (see Figure V.6) reflects, for the most part, the co-variation of the two principal loadings: 'distance to CBD' and 'relative accessibility' - both of which reflect the circular symmetry which characterises Christchurch Urban Area.

The preceding analyses have indicated, albeit in explanatory sketch fashion, that the location of a sub-area within an urban system can be expected to exert a certain measure of constraint on the travel behaviour of urban residents. In Christchurch, for example, an area's general accessibility tends to vary with its distance from the centre of the city - due to the configuration of the urban area. Residents of outer suburbs are therefore at a greater disadvantage compared with their inner city counterparts in terms of relative access to any set of localities within the urban area. However, this apparent disadvantage could be either reinforced, reversed or removed, depending upon individual resident's ease of overcoming distance (e.g. by car ownership; being well provided for by public transport); and, as well, their range (location-wise) of contacts throughout the city.

Furthermore, the component analyses of journey to work structure suggest differential access to workplaces for various locations within the urban area (differential access being inferred from the nature of the travel mode

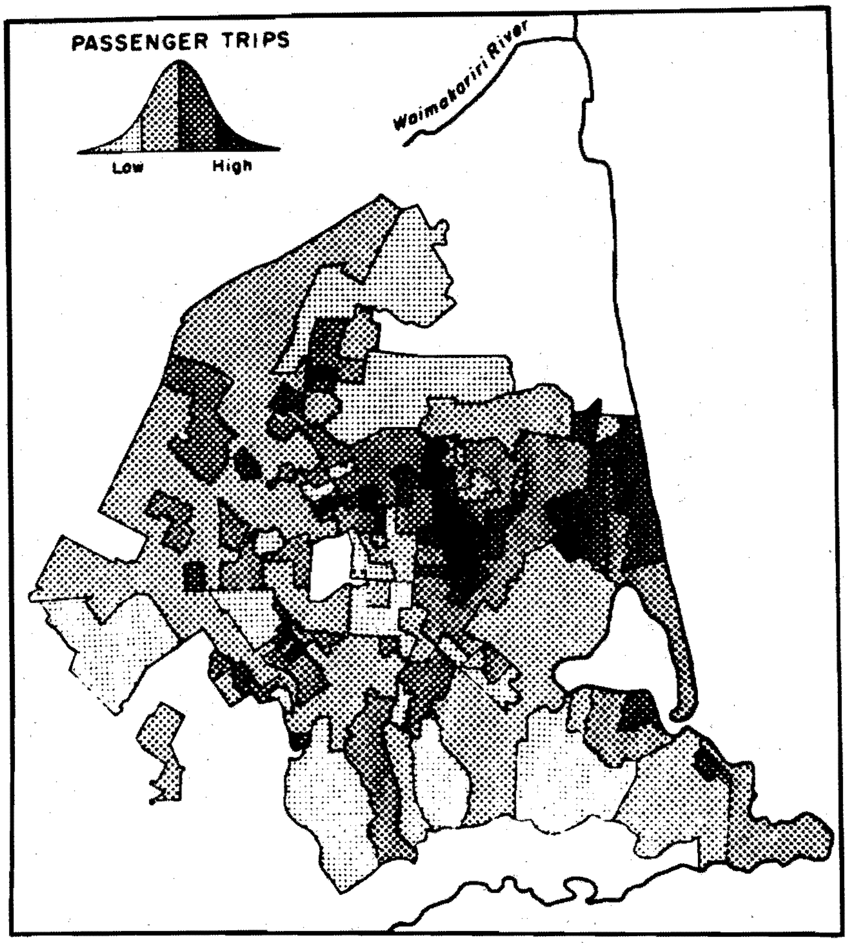


FIGURE V.5 : CHRISTCHURCH : PASSENGER TRIP MODE

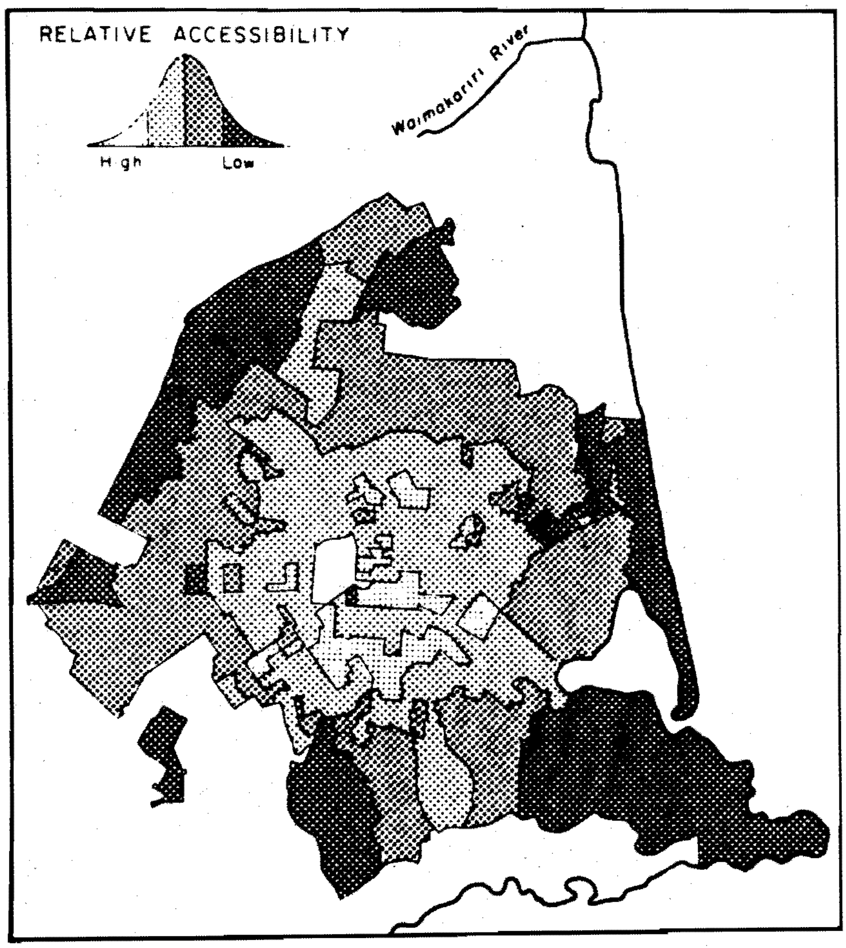


FIGURE V.6 : CHRISTCHURCH : RELATIVE ACCESSIBILITY adopted for the journey to work; and from the location of the major centres of employment within the city - see Figure I.4). A more affirmative statement on such a linkage would require information on resident preferences for particular journey to work modes, and origin - destination data for individual journey to work modes (not available at the time of the present study). It is thought, however, that the regionalisations undertaken in Chapter 5 should accommodate the major aspects of inner city - suburban variation in relative accessibility, and the location of particular sub-areas in relation to major employment nodes.

APPENDIX VI.1

CHRISTCHURCH MOBILITY SURVEY SCHEDULES

Department of Geography
University of Canterbury Christchurch 1 New Zealand

CONFIDENTIAL

CHRISTCHURCH
RESIDENTIAL MOBILITY SURVEY
1974

Dear Householder,

The questionnaire attached to this covering letter is part of a research project being undertaken into residential location and residential choice within Christchurch. It is becoming increasingly important for all those who plan cities to understand what makes people dissatisfied with their homes and neighbourhood, what factors finally induce movement to another location, how these people proceed to search for a new home, the extent to which their housing needs or desires are met and so on. This survey is designed to focus on these and other related issues. The project is being undertaken by Peter Newton, a Teaching Fellow and Doctoral candidate in the Department of Geography, University of Canterbury. Supervising the research is Dr. Ron Johnston, Reader in Geography, University of Canterbury.

Since it is impossible to interview all residents of Christchurch we resort to what is called a sample. Your household, along with nearly one thousand others in Christchurch, was selected at random as part of the sample for this project.

The present research project is not being undertaken for any private or public body. The information contained in the questionnaire will remain entirely confidential. The overall results of the study will be made available to all interested individuals as well as local or government bodies, however.

On completion of the questionnaire, please return it in the addressed, post-paid envelope which is provided. No extra stamps are required.

Should you have any queries regarding any part of the questionnaire, or the survey as a whole, please don't hesitate to phone the number listed below.

Thanking you in anticipation of your co-operation.

Peter W. Newton.

Peter W. Newton,
Department of Geography,
University of Canterbury.
Phone: 65-819, Ext. 609

Notes:

1. Please answer each question. The mode of response for each question will be clearly indicated on the interview schedule.
2. Please return, via post, the completed questionnaire as soon as possible.
3. It is important that only an adult member of the household completes this questionnaire. To avoid possible confusion in completing the questionnaire it should be mentioned that there are a number of types of household. The most common type is the one which comprises a husband and wife, either with or without children. Then there are households which comprise an individual adult - either single, separated, widowed or divorced (perhaps including children). The list of household types can be extended to include unmarried couples or groups of adults (of the same or mixed sex) sharing the same dwelling.

The present questionnaire aims to cover all types of household, although there are, quite obviously, some questions which may not be relevant to certain households. These will be apparent and should not be the cause of concern. Simply state 'NOT RELEVANT' where this problem arises for a particular question.

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CHRISTCHURCH RESIDENTIAL MOBILITY SURVEY

INTERVIEW NUMBER:

PART 1

In the first part of the questionnaire we would like to know of your plans or intentions regarding changing your place of residence in the near future.

To answer, please place ✓ in the appropriate box

e.g. ☑

1. Do you think there is any chance you (and your family) will move house in the next twelve months (that is, move sometime during 1974?)

☐ some chance
☐ no chance

If you think that there is SOME CHANCE that you will move during 1974, please answer Questions 2, 3, 4, 5, 6, 7 and 8. If you think that there is NO CHANCE that you will move during 1974, please answer Questions 9 and 10.

2. Would you say you definitely will move, you probably will, or are you uncertain?

☐ definitely will move
☐ probably will move
☐ uncertain

3. How long has your household been thinking about moving?

________ months

4. Do you expect to stay in Christchurch if you do move?

☐ Yes
☐ No

5. Have you already started to look seriously for a new dwelling?

☐ Yes
☐ No

6. Approximately, what date do you hope to move?

(month) / (year)

7 Briefly, why are you thinking of moving?

____

____

____

____

8 When you start looking for a place to move to, will you be looking for a place to rent or a place to buy or will you be having a new house built?

☐ Rent
☐ Buy Existing House
☐ Having House Built

If you think that there is NO CHANCE of you (and your family) moving during 1974, please answer Questions 9 and 10.

9 Have you ever thought seriously of moving from this home to another house in Christchurch?

☐ Yes
☐ No

10. If YES (to question 9)

(i) why did you think of moving?

____

____

(ii) when was the last time you thought about moving?

____

____

(iii) what made you stay where you are?

____

____

PART 2

In this section of the questionnaire, we would like you to recall the changes (if any) which have taken place in your household over the PAST TWELVE MONTHS (that is, Jan. 1973 to Dec. 1973).

We would also like you to think of any changes which are likely to come about over the NEXT TWELVE MONTHS (that is Jan. 1974 - December 1974).

A list of possible changes are given below, and space is provided to the right of each possible event for your response.
Please tick ✓ either YES or NO, whichever is appropriate.

	POSSIBLE CHANGES IN HOUSEHOLD	CHANGE OCCURRED OVER THE PAST 12 MONTHS	CHANGE LIKELY TO OCCUR OVER THE NEXT 12 MONTHS
1.	An increase in family size due to birth or adoption of a child?	☐ Yes ☐ No	☐ Yes ☐ No
2.	An increase in family size due to arrival of a sick or ageing parent or relative?	☐ Yes ☐ No	☐ Yes ☐ No
3.	One or more of your children left home (due to marriage, job, etc.)?	☐ Yes ☐ No	☐ Yes ☐ No
4.	Wife began or resumed either part-time or full-time work?	☐ Yes ☐ No	☐ Yes ☐ No
5.	Husband gained a large increase in salary?	☐ Yes ☐ No	☐ Yes ☐ No
6.	Husband changed job?	☐ Yes ☐ No	☐ Yes ☐ No
7.	Wife changed job?	☐ Yes ☐ No	☐ Yes ☐ No
8.	Husband promoted to a more senior position in his job?	☐ Yes ☐ No	☐ Yes ☐ No

Please note any other changes, not mentioned above, which have occurred in your household over the PAST 12 months, or which probably will occur over the NEXT 12 months.

(a) Changes over past 12 months: ______________________

____

(b) Changes likely during next 12 months: ______________________

____

9. In which type of dwelling are you currently living?

☐ Single family house
☐ Ownership Flat
☐ Flat or apartment

10. Do you own or rent your present dwelling?

☐ Own
☐ In process of buying/owning
☐ Renting
☐ Other

11. How many bedrooms are there in your present dwelling? ______________

PART 3

The objective of Part 3 of the questionnaire is to gain some basic information about those households being surveyed. This is required in order to determine whether or not there is any relationship between the type of household and its residential mobility behaviour.

Please tick ✓ the appropriate category of response.

1. How many people presently live in this dwelling?

_______ persons

2. What are their ages?

	0-4	5-14	15-19	20-29	30-39	40-49	50-64	Over 65
Head of household								
Spouse								
Children								
Others resident in the household								

(Note: If you have two children 0-4 years, place ✓✓ in 0-4 box)

3. How many of your children have matured and left home?

- [ ] None
- [ ] 1
- [ ] 2
- [ ] 3
- [ ] More than 3
- [ ] Not applicable

4. What is your present marital status?

- [ ] Married
- [ ] Separated/Divorced
- [ ] Widowed
- [ ] Single
- [ ] Other

5. If married, how many years have you been married?

_______ years

6. How many different houses or flats have you lived in (anywhere in New Zealand) since you have been married?

_______ moves

If a single person, how many moves have you made since leaving home?

_______ moves

7. What is the present occupation of the head of the household? (If retired, please state nature of occupation immediately before retirement as well.)

____

8. What is the name and address of the head of household's place of employment?

____

____

9. Is the spouse currently working (either full-time or part-time)?

- [ ] Yes
- [ ] No
- [ ] Not applicable

10. Could you give an approximate indication of the head of the household's gross (i.e. before taxes) WEEKLY income?

- [ ] Not prepared to disclose this information
- [ ] Less than $50
- [ ] $50 - $75
- [ ] $76 - $100
- [ ] $101 - $150
- [ ] Over $150

11. What level of education did (a) the head of the household, and (b) the spouse, attain?

	(a) Head	(b) Spouse
Primary		
Intermediate (Forms 1 & 2)		
Form 4 (15 years of age)		
Form 5 (School Certificate)		
Form 6 (University Entrance)		
Form 7 (Bursary)		
Technical College		
Teachers' College		
University		

12. How long have you lived at your present address?

_______ Years _______ Months

13. What was your previous address?

_______ (street) _______ (suburb)

_______ (city/town)

14. Were either you or your husband/wife born in Christchurch?

- [ ] Yes
- [ ] No

PART 4

This part of the questionnaire focuses on your PRESENT dwelling, and to some extent on your neighbourhood or local area.

The following is a list relating to certain aspects of your present dwelling, neighbourhood and location with which you may not be completely satisfied. There will be certain things with which you are completely satisfied, others with which you are very dissatisfied, while there are others where there is only a slight trace of dissatisfaction. Alongside each statement is a scale which you can use to express your level of satisfaction with the particular feature mentioned.

Place a tick ✓ in the box which comes closest to representing the level of satisfaction you feel with the particular feature mentioned.

To what extent are you satisfied with the following	Completely Satisfied	Fairly Satisfied	Fairly Dissatisfied	Completely Dissatisfied	Not Applicable
1. The number of bedrooms in your dwelling					
2. The number of rooms in your dwelling					
3. The size of your section					
4. Garaging facilities for your vehicle					
5. The quality of schools in your district					
6. The distance your children are required to travel to school					
7. The location of recreational activities					
8. Closeness to public transport routes					
9. The frequency of bus services in your area					
10. The distance you are from the Square					
11. The distance you are from parks or open spaces					
12. The distance you have to travel to shop					
13. The distance the head of the household is required to travel to work					
14. Distance to relatives					
15. Distance to friends					
16. The appearance of your neighbourhood					
17. The style of your home					
18. The size of the rooms in your dwelling					
19. The layout of the rooms in your dwelling					
20. The type of neighbours you have					
21. The reputation of your neighbourhood					
22. The state of repair of your dwelling					
23. The amount of privacy you have from either neighbours or passers-by in the street					
24. The opinion that other people in the city have about your neighbourhood					
25. The amount of noise from your immediate neighbours					
26. The quietness of your neighbourhood in general					
27. The friendliness of the neighbours					
28. The cleanliness of your area					
29. The services provided by your local County, Borough or City Council					
30. The opinion that your friends, relatives or acquaintances have about your neighbourhood					
31. The opinion that your friends, relatives or acquaintances have about your house					
32. The cost of your annual rates					
33. The density (number and closeness) of building in your neighbourhood					
34. The amount of traffic in your street					

If there are other features of your house, neighbourhood or location with which you are not completely satisfied, please list them below and indicate your degree of dissatisfaction.

35.					
36.					

PART 5

This final section of the questionnaire should be completed by those households who think there is some chance, however slight, that they may move to some other house in Christchurch in the next year or so.

The main purpose of this section relates to the set of requirements you have for your NEXT house, neighbourhood and location in Christchurch.

HOUSE AND NEIGHBOURHOOD:

Listed below are some of the basic factors which are normally considered when a household is thinking of moving to a new house and neighbourhood. For each feature listed, please TICK ✓ the category which comes closest to representing your requirements for your NEXT HOUSE.

1. Number of bedrooms: ☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ More than 4	2. Age of dwelling: ☐ Built Pre -1900 ☐ 1900-1920 ☐ 1920-1940 ☐ 1940-1950 ☐ 1950-1960 ☐ 1960-1970 ☐ After 1970 ☐ Newly built
3. Size of Section (in perches): ☐ Under 15 ☐ 15-19 ☐ 20-24 ☐ 25-29 ☐ 30-34 ☐ 35-39 ☐ 40-44 ☐ 45-50 ☐ Over 50	4. Size of house (in 'squares'; 1000 sq.ft. = 10 squares) ☐ Under 10 squares (small) ☐ 10-14 squares (average) ☐ Over 14 squares (large)
5. Building materials - WALLS: ☐ Brick, concrete block or stone ☐ Weatherboard ☐ Other	6. Building materials - ROOF: ☐ Tile ☐ Iron ☐ Other
7. Condition of dwelling: ☐ Very good ☐ Good ☐ Fair ☐ Poor	8. Number of garage spaces: ☐ 0 ☐ 1 ☐ 2 ☐ More than 2
9. Could you give some idea of the price range you will be working within when looking for your next house? $ ______________ to $ ______________	
10. What proportion of this will be required to come from a loan (i.e. from State Advances, Building Society, Insurance Company or any other source)? ☐ None ☐ About 1/4 ☐ About 1/2 ☐ About 3/4 ☐ More than 3/4	11. Type of dwelling: ☐ Single family house ☐ Ownership flat ☐ Apartment in multi-unit block ☐ Other (specify) ______________

12. About how many people in your present neighbourhood are on a similar economic level as you? (Economic level encompasses such things as occupation and income.)

- [ ] Most of them
- [ ] Some of them
- [ ] Few of them
- [ ] None of them
- [ ] Don't know

13. What proportion of people in your next neighbourhood would you like to have a similar economic level to yours?

- [ ] Most of them
- [ ] Some of them
- [ ] Few of them
- [ ] None of them

14. About how many people in your present neighbourhood are in the same general age group as yourself (excluding children)?

- [ ] Most of them
- [ ] Some of them
- [ ] Few of them
- [ ] None of them
- [ ] Don't know

15. What proportions of people in your next neighbourhood would you like to have in a similar age group to yours?

- [ ] Most of them
- [ ] Some of them
- [ ] Few of them
- [ ] None of them

LOCATION:

When you make your next move, we would like to know whether you would rather be closer, about the same distance or farther away from the set of places listed below. Please tick ✓ the appropriate category.

	I would prefer my NEXT location to be:			
	Closer to	About the same distance from	Farther away from	Doesn't matter
1. The place where you do most of your shopping				
2. The homes of your best friends				
3. A primary school				
4. The Square				
5. A park or open space				
6. Your workplace				
7. Your husband/wife's workplace				
8. Your church				
9. Public transport routes				
10. The outskirts of the city				

We may want to contact you at the end of this year to find out whether you are still living at the same address or whether you have moved.
We would appreciate it if you could give us the name, address, and phone number if possible of a friend or relative living in Christchurch who could aid in locating you in case you do move.

NAME:

ADDRESS:

PHONE:

Name of person who filled in this questionnaire:

Mr./Mrs./Miss* ____________________
(Surname)

* Cross out whichever is not applicable

- Thank you for your co-operation -

APPENDIX VI.2

PERCENTAGE DISTRIBUTION OF RESPONSES TO
SATISFACTION - DISSATISFACTION ITEMS

ITEM	MEAN	SIGMA	RESPONSE MODE * 0	1	2	3	4
1	1.55	0.89	2	60	26	7	5
2	1.60	0.84	2	53	32	9	4
3	1.49	0.91	6	58	22	9	5
4	1.65	1.05	5	52	25	8	9
5	1.04	0.94	29	50	14	5	2
6	0.83	0.86	39	45	13	2	1
7	1.51	0.92	10	44	35	7	4
8	1.31	0.82	5	71	18	4	2
9	1.66	1.03	6	49	27	10	8
10	1.25	0.59	2	74	22	1	1
11	1.31	0.70	2	73	19	4	2
12	1.39	0.76	2	68	22	4	3
13	1.29	0.89	15	53	23	6	3
14	1.29	0.97	15	54	24	3	4
15	1.42	0.79	7	53	32	6	2
16	1.89	0.92	2	33	45	11	8
17	1.72	0.95	3	45	37	6	6
18	1.68	0.87	2	47	36	13	2
19	1.72	0.89	3	44	37	12	5
20	1.60	0.61	2	50	37	7	4
21	1.55	0.87	3	55	29	6	5
22	1.55	0.81	2	55	31	6	3
23	1.61	0.87	1	56	28	10	5
24	1.49	0.97	12	45	31	7	5
25	1.45	0.85	3	64	21	6	5
26	1.59	0.85	2	54	33	6	5
27	1.55	0.82	3	53	34	6	4
28	1.69	0.82	2	44	41	10	4
29	1.79	0.82	3	34	49	10	4
30	1.46	0.90	11	46	33	7	3
31	1.36	0.80	11	49	34	4	2
32	1.61	1.16	22	21	39	11	8
33	1.66	0.84	2	46	38	9	4
34	1.85	0.99	3	41	35	12	10

* 0 : NOT APPLICABLE
1 : COMPLETELY SATISFIED
2 : FAIRLY SATISFIED
3 : FAIRLY DISSATISFIED
4 : COMPLETELY DISSATISFIED
ITEMS 1-34 ARE LISTED IN PART 4 OF QUESTIONNAIRE